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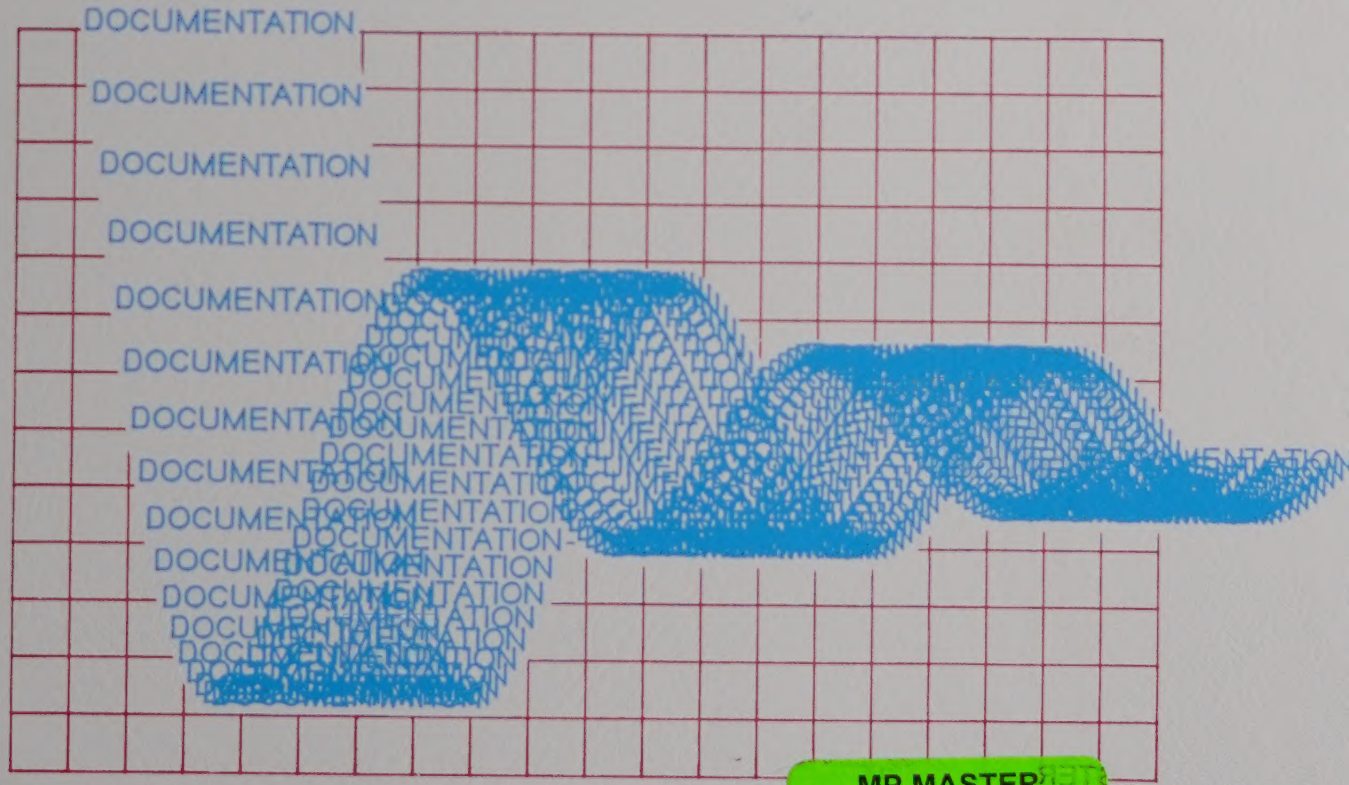


MP MASTER
MA20676

ROHDE&SCHWARZ

Test and Measurement
Division

Software Manual

GSM/EDGE Mobile and Base Station Test for Spectrum Analyzers R&S FSP und R&S FSU

Application Firmware R&S FS-K5

1141.1496.02

Printed in the Federal
Republic of Germany

Dear Customer,

throughout this manual, FS-K5 is generally used as an abbreviation for the software option R&S FS-K5. The Spectrum Analyzers R&S FSP and R&S FSU are abbreviated as FSP and FSU, respectively.

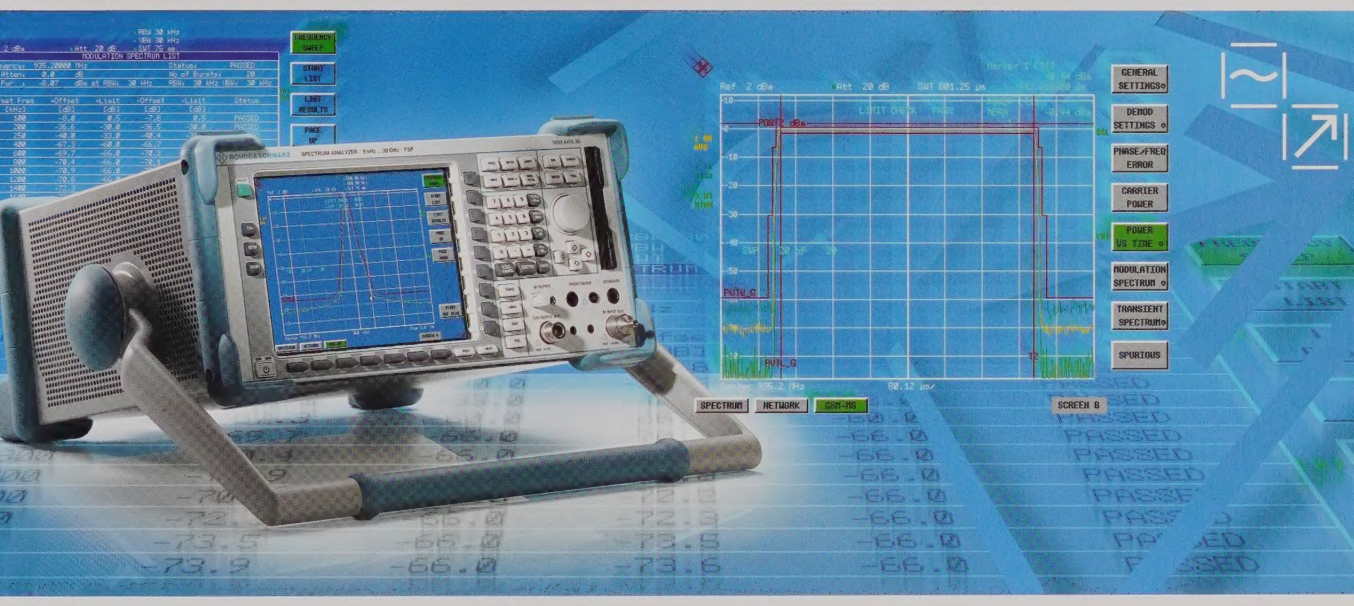
Tabbed Divider Overview

Data Sheet

Safety Instructions
Certificate of quality
Support Center
List of R&S Representatives

Tabbed Divider

1	Chapter 1:	Basics
2	Chapter 2:	Measurements
3	Chapter 3:	Remote Control
4	Chapter 4:	Index



GSM/EDGE Application Firmware R&S FS-K5 for R&S FSP and R&S FSU

The solution for easy and fast GSM and EDGE measurements

- GSM/EDGE push-button measurements
- Fast modulation spectrum routine
- Easy to use
- Accurate carrier power measurement
- Multislot capability
- Enhanced timing accuracy with 8 samples/symbol

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Characteristics

The Application Firmware R&S FS-K5 allows the user to perform the most important GSM and EDGE transmitter measurements at the push of a button:

- Phase/frequency error (GSM)
- Modulation accuracy (EDGE) including 95:th percentile, origin offset suppression, EVM and frequency error
- Power versus time incl. carrier power
- Carrier power
- Modulation spectrum
- Transient spectrum
- Spurious emissions

Only the carrier frequency and the external attenuator have to be set manually.

The Application Firmware R&S FS-K5 can be installed in all models of the R&S FSP and R&S FSU spectrum analyzer families:

R&S FSU3 20 Hz to 3.6 GHz	R&S FSP3 9 kHz to 3 GHz	Covers the basic TX frequency range
R&S FSU8 20 Hz to 8 GHz	R&S FSP7 9 kHz to 7 GHz	Adds harmonics measurement capability
–	R&S FSP13 9 kHz to 13 GHz	Covers the entire spurious emissions frequency range
R&S FSU26 20 Hz to 26 GHz	R&S FSP30 9 kHz to 30 GHz	Adds microwave link frequency ranges

The application firmware can be used throughout the total frequency range of the basic spectrum analyzer. This covers all GSM bands of interest such as GSM900, GSM 1800, GSM 1900, R-GSM, GSM 450 and even IF frequencies used in transmitters and receivers.

Features and benefits

R&D, development

The R&S FSP is the ideal development tool with easy-to-use GSM measurement functions in a cost-effective analyzer. The workhorse for every engineer, especially in mobile development. The R&S FSU provides the dynamic range required in base station development, verification and production testing.

Low measurement uncertainty for high confidence

<0.5 dB total level uncertainty and <0.7° phase error for GSM

Designed for speed

Fast modulation spectrum routine for frequency list mode:
± 1.8 MHz/200 bursts in <25 seconds, 1 active slot
± 1.8 MHz/200 bursts in <8 seconds, 8 active slots

Really portable – usable anywhere

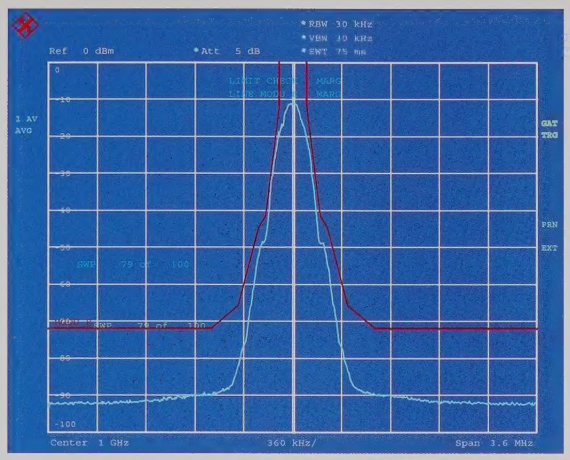
- Lightweight, <11 kg with R&S FSP3
- Comprehensive documentation and storage of results and hard copies on internal hard disk, subsequent printing or transfer to a PC – even via LAN/Ethernet
- Optional DC power supply and battery pack for R&S FSP

Trigger functions to meet many demands

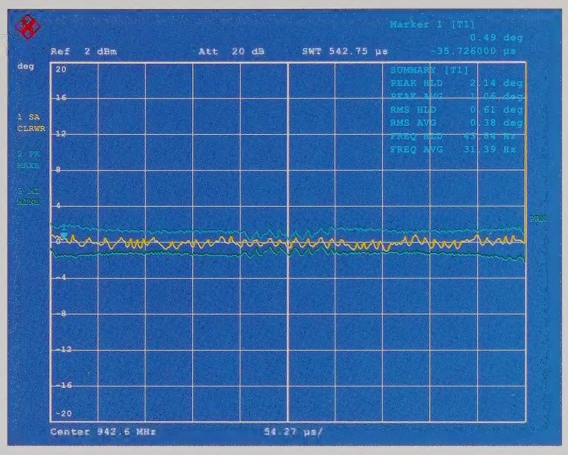
- Simplified test setup, no trigger from device under test necessary
- IF power trigger for gated measurements with selectable trigger level
  - R&S FSU: –50 dBm to –10 dBm
  - R&S FSP: –30 dBm to –10 dBm (10 MHz bandwidth)
- RF power trigger with enhanced sensitivity for R&S FSP: option R&S FSP-B6 (–50 dBm to –10 dBm)

Certified Environmental System ISO 14001 REG. NO 1954

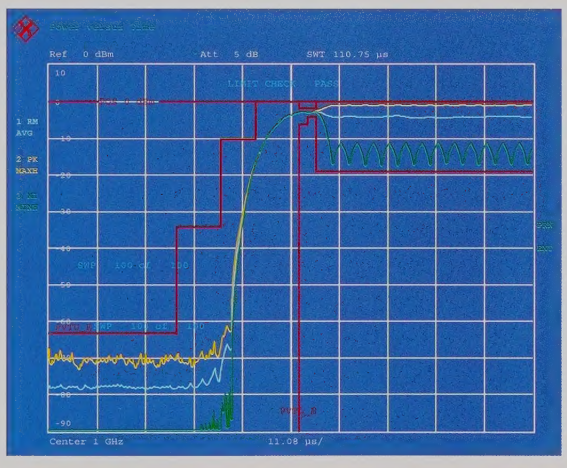
Certified Quality System ISO 9001 DQS REG. NO 1954



Modulation spectrum measurement in frequency sweep mode



Phase/frequency error measurement: peak as well as average values over 200 bursts are indicated for RMS phase error and peak phase error



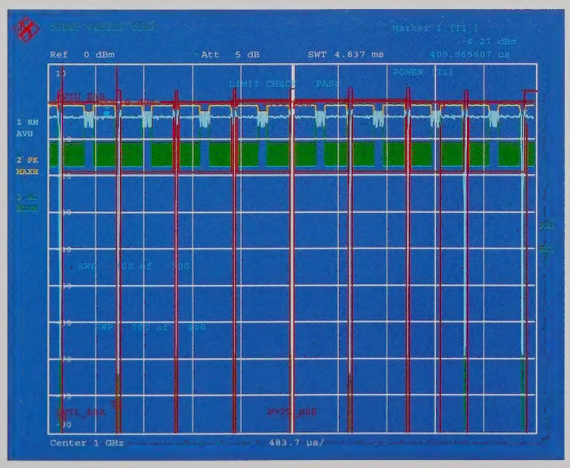
Power-versus-time measurement: details of burst can be zoomed – rising edge, falling edge, high resolution display of top of burst

MODULATION SPECTRUM LIST

Frequency: 1.00000 GHz
Status: PASSED
Ext Atten: 0.0 dB
No of Bursts: 100
Ref Pwr : -11.96 dBm at RBW: 30 kHz
RBW: 30 kHz VBW: 30 kHz

Offset Freq [kHz]	+Offset [dB]	+Limit [dB]	-Offset [dB]	-Limit [dB]	Status
100	-7.7	0.5	-7.4	0.5	PASSED
200	-36.5	-30.0	-36.2	-30.0	PASSED
250	-40.5	-33.0	-39.9	-33.0	PASSED
400	-70.4	-54.0	-70.1	-54.0	PASSED
600	-77.6	-60.0	-77.8	-60.0	PASSED
800	-81.0	-60.0	-81.4	-60.0	PASSED
1000	-83.3	-60.0	-83.1	-60.0	PASSED
1200	-84.3	-60.0	-84.4	-60.0	PASSED
1400	-85.0	-60.0	-85.0	-60.0	PASSED
1600	-85.1	-60.0	-85.3	-60.0	PASSED
1800	-85.4	-60.0	-85.5	-60.0	PASSED

Modulation spectrum measurement in list mode using a dedicated routine for fast measurements also when averaging over a large number of bursts

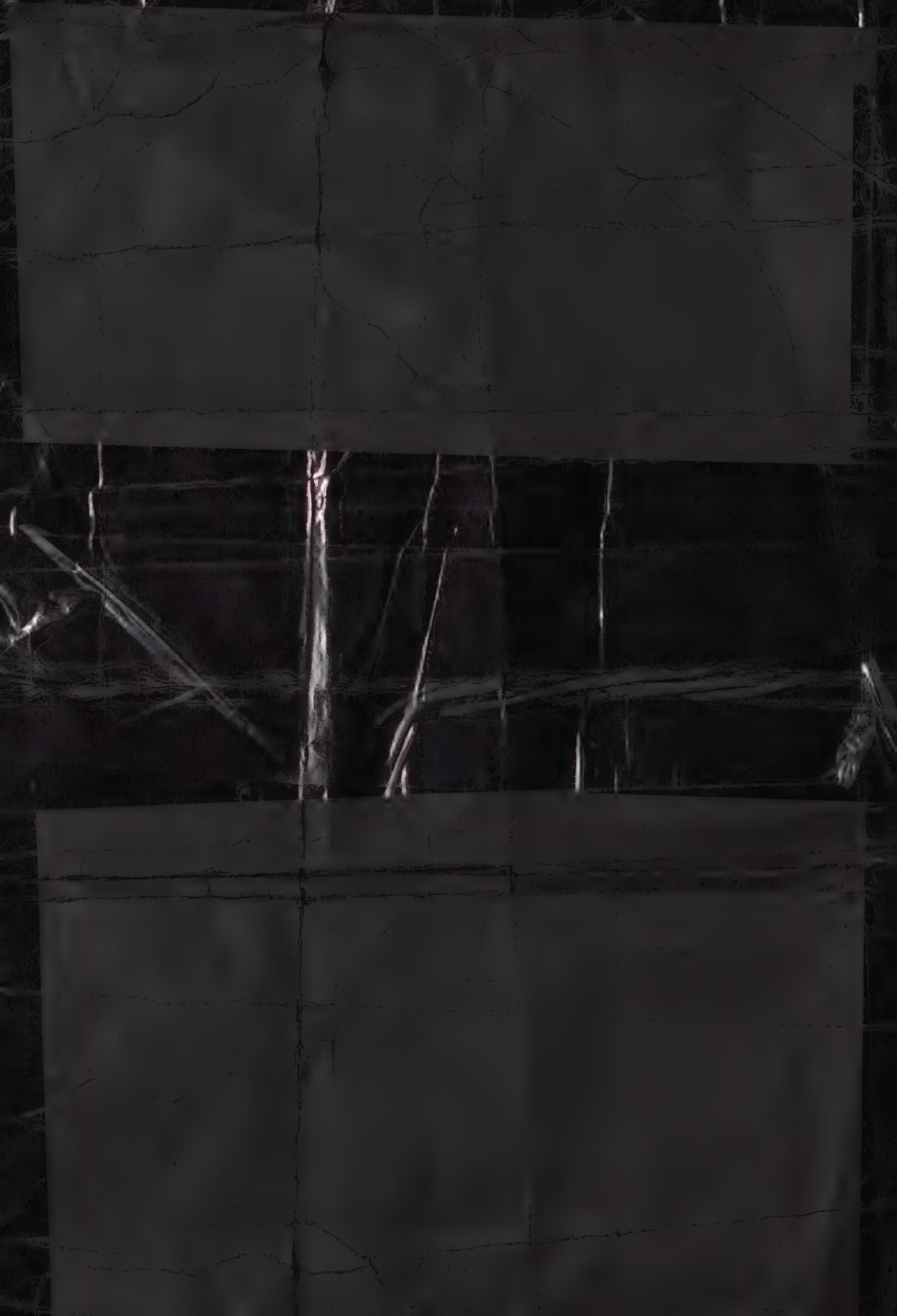


Multislot power-versus-time measurement: up to 8 active slots can be measured

Specifications

Specifications apply under the following conditions: 15 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed.
Data designated "nominal" apply to design parameters and are not tested.
The specifications below apply to the R&S FSPx (FSP3/7/13/30), R&S FSUx (FSU3/8/26) equipped with R&S FS-K5. They are based on the data sheet specifications of the Spectrum Analyzers R&S FSP and R&S FSU and are not checked separately. Level measurement uncertainties given with a tolerance are measurement uncertainties with a confidence level of 95%. Data without tolerances are typical values at 900 MHz.
The specified level measurement errors do not take into account systematic errors due to the reduced S/N ratio.

Measurement	Specification		Test specification and permissible measurement uncertainty to I-ETS 300 609-1
	R&S FSP3/7/13/30	R&S FSU3/8/26	
Phase/frequency error (GMSK modulation)			11.10.1 13.1
Phase error, floor (S/N >40 dB)			
RMS	<0.7°	<0.5°	
Peak	<2°	<1°	
Phase error, uncertainty (S/N >40 dB)			
RMS		<0.2°	<1.5°
Peak		<0.7°	<5°
Frequency error uncertainty (S/N >40 dB)		<1.5 Hz + error of reference frequency	±10 Hz
Modulation accuracy ($3\pi/8$ shifted 8PSK modulation)			
EVM, residual (S/N >40 dB)			
RMS	<0.5%	<0.25%	
Peak	<1.5%	<1%	
95:th percentile	<1.5%	<1%	
Resolution	0.03%	0.03%	
Frequency error uncertainty (S/N >40 dB)		<1 Hz + error of reference frequency	
Origin offset suppression (S/N >40 dB)			
Measurement range		–20 dBc to –50 dBc	
Mean carrier power			11.10.1 13.3
Absolute level uncertainty (–50 dBm to +30 dBm, 10 MHz to 3 GHz)	0.5 dB	0.3 dB	1 dB
Relative level uncertainty (from 0 dB to –50 dB from reference level)	0.2 dB	0.1 dB	0.7 dB
Power versus time			11.10.1 13.3
Uncertainty of reference	0.5 dB	0.3 dB	1 dB
Relative uncertainty		0.2 dB (0 dB to –50 dB from reference) 0.5 dB (–50 dB to –70 dB from reference)	0.7 dB
Internal symbol timing uncertainty		70 ns	¼ bit
Dynamic range (RBW = 600 kHz)	70 dB (with trace average) 60 dB (with peak hold)	76 dB (with trace average) 66 dB (with peak hold)	
Spectrum due to modulation			11.10.1 13.4
Level measurement uncertainty			
Absolute (–50 dBm to +30 dBm, 10 MHz to 3 GHz)	0.5 dB	0.3 dB	1 dB
Relative[1)]			
$\Delta f \leq 0.1$ MHz	0.2 dB	0.1 dB	0.5 dB
0.1 MHz $< \Delta f \leq 1.8$ MHz (0 dBc to –70 dBc)	0.2 dB	0.1 dB	0.7 dB
1.8 MHz $< \Delta f \leq 6$ MHz	0.5 dB	0.5 dB	1.5 dB
$\Delta f \geq 6$ MHz	0.5 dB	0.5 dB	2 dB
Dynamic range (carrier power = 30 dBm)			
Frequency offset			
200 kHz	65 dB	74 dB	
400 kHz	67 dB	78 dB	
600 kHz	68 dB	80 dB	
1200 kHz	72 dB	87 dB	
1800 kHz	76 dB	88 dB	
1.8 MHz to 6 MHz (RBW = 100 kHz)	76 dB to 84 dB	83 dB to 85 dB	
>6 MHz (RBW = 100 kHz)	84 dB	85 dB	



Measurement	Specification		Test specification and permissible measurement uncertainty to ETS 300 609-1
	R&S FSP3/7/13/30	R&S FSU3/8/26	
Spectrum due to transients			11.10.1 13.4
Level measurement uncertainty			
Absolute (–50 dBm to +30 dBm, 10 MHz to 3 GHz)	0.5 dB	0.3 dB	1.5 dB
Relative[1]			
0 dB to 50 dB from reference level	0.2 dB	0.2 dB	0.7 dB
>50 dB from reference level	0.5 dB	0.5 dB	1.5 dB
Dynamic range with 30 dBm mean carrier power			
Frequency offset			
400 kHz	62 dB	72 dB	
600 kHz	64 dB	75 dB	
1200 kHz	68 dB	82 dB	
1800 kHz	71 dB	84 dB	

[1] Does not include the level uncertainty due to R&S FSP inherent noise.

Ordering information

Order designation	Type	Order No.
GSM/EDGE Application Firmware for Spectrum Analyzers R&S FSP and R&S FSU	R&S FS-K5	1141.1496.02
Recommended extras and options[1]		
Electronic Attenuator for R&S FSP3/7, 0 dB to 30 dB, 5 dB steps, 20 dB preamplifier (not for R&S FSP13/30)	R&S FSP-B25	1129.7746.02
Electronic Attenuator for R&S FSU3/8/26, 20 dB preamplifier	R&S FSU-B25	1144.9298.02
TV Trigger and Adjustable RF Power Trigger	R&S FSP-B6	1129.8594.02

[1] For further options and recommended extras see R&S FSPx data sheet (PD 0757.5137) and R&S FSUx data sheet (PD 0757.6504).

Printed in Germany 0202

PD 0758.[illegible]72 · GSM/EDGE Application Firmware R&S FS-K5 for R&S FSP and R&S FSU · Trade names are trademarks of the owners · S[illegible] change · Data without tolerances: typical values

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Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S:

Observe operating instructions

Weight indication for units >18 kg

PE terminal

Ground terminal

Danger! Shock hazard

Warning! Hot surfaces

Ground

Attention! Electrostatic sensitive devices require special care

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   IP degree of protection 2X, pollution severity 2 overvoltage category 2, only for indoor use, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

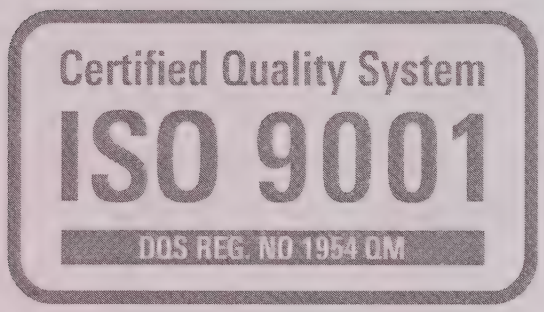
10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.
11. Lithium batteries must not be exposed to high temperatures or fire.

    Keep batteries away from children.

    If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).

    Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.

    Do not short-circuit the battery.
12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.
13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.
14. The outside of the instrument is suitably cleaned using a soft, lint-free dustcloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.
15. Any additional safety instructions given in this manual are also to be observed.



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Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

Certificate of quality

Dear Customer,

You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde & Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

Certificat de qualité

Cher client,

Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde & Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

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Table of Contents – Chapter 1 "General Information"

1 General Information on Application Firmware FS-K5, GSM/EDGE Mobile and Base Station Tests

A brief explanation of GSM (GMSK and EDGE) **1.1**
Firmware application FS-K5 ..... **1.5**
Installing the FS-K5 firmware application 1.6
Starting the application 1.6
The application's general settings 1.7
Measuring with the application 1.7
Aborting a measurement 1.8
Results of measurements 1.8
Exiting the application 1.9
Transducer Factors **1.10**
Trigger options **1.10**
Trigger and time references 1.11
Possible errors and difficulties during measurement **1.13**
Messages in GSM/EDGE mode **1.14**

Figures

Figure 1-1 Data transmission in GSM network - T&FDMA communication 1.2
Figure 1-2 Start screen in GSM/EDGE mode 1.7
Figure 1-3 Trigger setting in *GENERAL SETTINGS* menu 1.11
Figure 1-4 Trigger and time references 1.12

Tables

Table 1-1 Downlink – base station transmitting to mobile 1.3
Table 1-2 Uplink – mobile transmitting to base station 1.3
Table 1-3 Results of measurements 1.8
Table 1-4 Trigger options 1.10
Table 1-5 Trigger settings in GSM trigger mode 1.10

1 General Information on Application Firmware FS-K5, GSM/EDGE Mobile and Base Station Tests

A brief explanation of GSM (GMSK and EDGE)

The GSM (Global System for Mobile Communication) standard describes the GSM mobile radio network that is in widespread use today. To enhance this network the 8PSK modulation has been defined in addition to the existing GMSK modulation. With 8PSK the mobile or base station operates in the EDGE (Enhanced Data rates for GSM Evolution) mode.

This means that GSM includes two different modes: GMSK and EDGE. The term EDGE is used only wherever there are significant differences between the two modes. In all other cases, the term GSM will be used.

There are two different standards, distinguished primarily by their frequency bands: ETSI (for GSM900, GSM1800) and J-STD-007 (PCS 1900 , primarily in the USA).
The physical layer – the layer of the GSM network on which modulation, transmission of RF signals, reception of RF signals, and demodulation take place – is defined in the standards

GSM 05.04	Modulation
GSM 05.05 (ETS 300 910)	General measurement specifications and limit values
GSM 11.10 (ETS 300 607-1)	Detailed measurement specifications and limit values for mobiles
GSM 11.21 (ETS 300 609-1) and	Detailed measurement specifications and limit values for base stations
J-STD 007	Detailed measurement specifications and limit values for mobiles and base stations in the 1900 MHz band

As technological development progresses, J-STD 007 is now being integrated into the other GSM standards.

A T&FDMA method is used to transfer data in the GSM network. This means that the digital information is transmitted discretely in the time domain as well as in the frequency domain.

The time domain is divided logically into frames of different length, the smallest unit being known as a timeslot. A multiframe consists of 26 frames, and a frame has 8 timeslots (see GSM 05.01 for details).

A mobile, therefore, does not communicate continuously with the base station; instead, it communicates discretely in individual timeslots. In the simplest case, 8 mobiles share the 8 timeslots of a frame (TDMA - Time Division Multiple Access).

The frequency domain absolute frequency channel number is divided into frequency bands, and each band, in turn, is subdivided into channels.

Each frequency channel is identified by its center frequency and a number, known as the ARFCN, which is a non-band-specific identifier (ARFCN - absolute radio frequency channel number). A bandwidth of 200 kHz is defined for each frequency channel.

Communication between a mobile and the base station can be either frequency-continuous or frequency-discrete – distributed across various frequency channels (FDMA – Frequency Division Multiple Access). In the standards, the abbreviation "SFH" (slow frequency hopping) is used to designate this mode of communication.

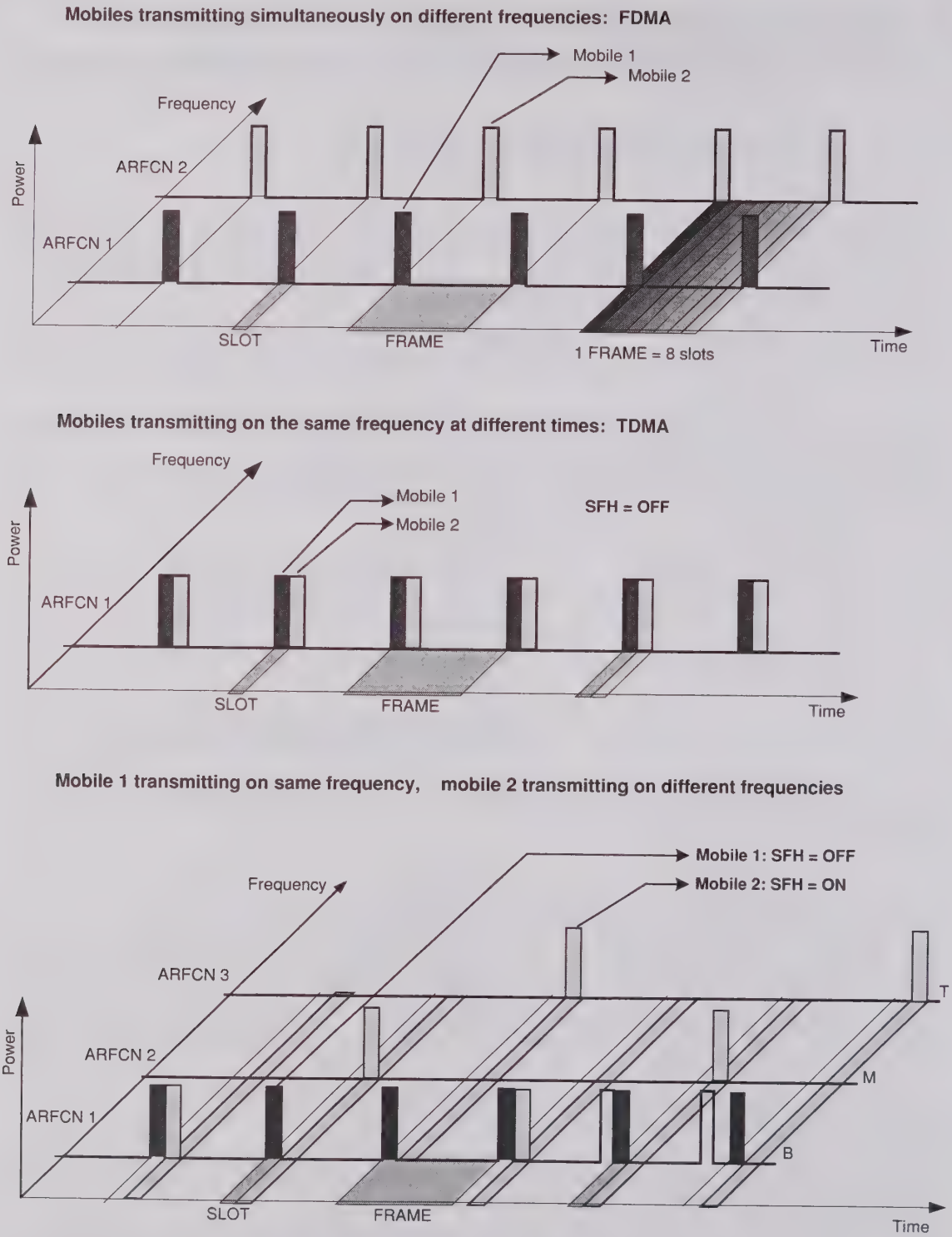


Figure 1-1 Data transmission in GSM network - T&FDMA communication

Base station and mobile communicate in different frequency ranges. The mobile sends in the "uplink", and the base station in the "downlink".

The frequencies specified in the standards plus their channel numbers are listed in the tables below.

Table 1-1 Downlink – base station transmitting to mobile

P-GSM 900	935.2MHz					959.8MHz	FREQ
	1					124	ARFCN
E-GSM 900	925.2MHz	934.8	935	935.2		959.8MHz	FREQ
	975	1023	0	1		124	ARFCN
R-GSM 900	921.2MHz	934.8	935	935.2		959.8MHz	FREQ
	955	1023	0	1		124	ARFCN
DCS 1800	1805.2MHz					1879.8MHz	FREQ
	512					885	ARFCN
PCS 1900	1930.2MHz					1989.8MHz	FREQ
	512					810	ARFCN
GSM 450	460.6MHz					467.4MHz	FREQ
	259					293	ARFCN
GSM 480	489MHz					495.8MHz	FREQ
	306					340	ARFCN
GSM 850	867.2MHz					893.8MHz	FREQ
	128					251	ARFCN

Table 1-2 Uplink – mobile transmitting to base station

P-GSM 900	890.2MHz					914.8MHz	FREQ
	1					124	ARFCN
E-GSM 900	880.2MHz	889.8	890	890.2		914.8MHz	FREQ
	975	1023	0	1		124	ARFCN
R-GSM 900	876.2MHz	889.8	890	890.2		914.8MHz	FREQ
	955	1023	0	1		124	ARFCN
DCS 1800	1710.2MHz					1784.8MHz	FREQ
	512					885	ARFCN
PCS 1900	1850.2MHz					1909.8MHz	FREQ
	512					810	ARFCN
GSM 450	450.6MHz					457.4MHz	FREQ
	259					293	ARFCN
GSM 480	479MHz					485.8MHz	FREQ
	306					340	ARFCN
GSM 850	824.2MHz					848.8MHz	FREQ
	128					251	ARFCN

At this time, two different modes of modulation are used in the GSM mobile radio network. The original GMSK method has now been joined by an 8PSK method (EDGE).

The GMSK symbol rate is 1/T = 1625/6 ksymb/s (in other words, approx. 270.833 ksymb/s). This corresponds to 1625/6 kbit/s (in other words approx. 270.833 kbit/s). In this method, a bit change represents a symbol. The details are laid down in ETSI standard GSM 05.04.

The 8PSK (EDGE) symbol rate is 1/T = 1625/6 ksymb/s (in other words, approx. 270.833 ksymb/s). This corresponds to 3 x 1625/6 kbit/s (in other words approx. 812.5 kbit/s).
in this method, three bits represent a symbol. The details are laid down in ETSI standard GSM 05.04.

In both cases, however, the channel bandwidth is restricted to 200 kHz. As these figures show, the EDGE bit rate is approx. three times higher than that of the GMSK method.

The customers' demand for higher telecommunication speeds increases the demand for bandwidth. Therefore the GSM standard has to evolve constantly. An example of this development is the recently introduced EDGE specification and the GPRS and HSCSD modes.

Until now, each mobile could use only one timeslot per frame, but the new HSCSD and GPRS methods will allow permanent assignment of more than one timeslot per mobile, plus dynamic utilization of multiple timeslots.

The concept behind GPRS (General Packet Radio Service) is dynamic assignment of up to 8 timeslots to each mobile for data transmission, depending on demand (and availability in the network).

HSCSD (High Speed Circuit Switched Data) allows permanent assignment of up to 4 timeslots to a mobile.

The two modulation modes GMSK and EDGE can be used.

Of significance for the FS-K5 application firmware in this respect is that the mobile can send power on a frequency in more than one timeslot.

Note: *In this manual, the functions described are illustrated by means of an FSP.*

Firmware application FS-K5

The characteristics of the GSM system as outlined above have to be measured in development and production and checked against limit values. The characteristics belonging to the physical layer that have to be checked include:

The characteristics of GMSK modulation:	Phase/frequency error
The characteristics of 8PSK modulation:	Modulation accuracy
Carrier power versus time	Power, time characteristic of power, and timing offset of power within a timeslot/several timeslots are checked.
The spectral characteristics	The spectral distribution of the energy is measured in the frequency channel, in the transmit band and outside the transmit band. A distinction is made between two causes for the form of spectral distribution: 1) The spectrum caused by GMSK or 8PSK (EDGE) modulation (measurement is performed only in that part of the timeslot in which power is virtually constant, in other words the switching ramps are ignored). 2) The spectrum caused by switching of the power in a timeslot.

In accordance with these requirements, the standards define the six measurements supported in this firmware application.

The GSM/EDGE, FS-K5 application provides a convenient means of performing the measurements listed below for GSM900 (P-GSM, E-GSM and R-GSM), DCS1800 or PCS1900 mobiles or base stations (by analogy with the standards GSM 11.10, GSM 11.10-DCS, GSM11.10-1 and J-STD-007 Air Interface):

Characteristics of GMSK modulation:

• PFE Phase/frequency error	Measurement of phase and frequency error with synchronization to midamble, IQ offset and IQ imbalance

Characteristics of GMSK modulation:

• MAC Modulation Accuracy	Measurement of EVM, of 95:th percentile value, of origin offset suppression, of frequency error, of IQ offset and IQ imbalance with synchronization to midamble

Carrier power versus time

• CPW Carrier power	Measurement of carrier power
• PVT Power versus time	Measurement of carrier power versus time with synchronization to midamble

Spectral characteristics

• MOD Spectrum due to modulation	Measurement of spectrum due to modulation
• TRA Spectrum due to transients	Measurement of spectrum due to transients
• SPU Spurious	Measurement of spurious

Measurements are available for one slot per frame or for the adjustable multislot mode.
Limit values can be defined for each individual measurement. Some basic limit values are predefined and can be changed or supplemented by other limit values.

The limit lines of GSM and EDGE signals are denoted by the extensions _G or _E, respectively . Single-slot and multislot limit lines (PVT) are distinguished by means of a digit appended to the letter _G or _E.

In the PVT, MOD and TRA (only BTS) measurement modes, the limit values depend on the measured power of the device. An arbitrary midamble can be defined for GMSK and EDGE (8-PSK). These measurements are preceded by reference measurements to furnish the correct level setting as required by the standard.

The PFE and PVT measurement modes require a time reference to the midamble (TSC 0 to 7). The IF signal is digitized, demodulated and processed (IQ mode) for these measurements.
The sections below contain basic information on the main procedures, settings and messages of the device. The descriptions of the measurements in Chapter 2 contain more detailed information specific to the various modes of measurement. The background information in the sections entitled "Additional information" in Chapter 2 is supplementary in nature and not necessary for normal operation. This information merely explains in more detail the internal settings and procedures. Chapter 3 describes the application's remote-control commands. The relevant commands also accompany each description of a softkey.

Installing the FS-K5 firmware application

When shipped ex works, the FS-K5 firmware application is preinstalled and enabled and can be used right away.
When shipped separately, the FS-K5 firmware application is accompanied by the latest version of the instructions for installation and enabling. Notes e.g. on compatibility between firmware and other applications are provided in the release notes for each firmware version.

Starting the application

Press the *GSM/EDGE* hotkey to start the GSM/EDGE, FS-K5 application. The GSM/EDGE mode is now active, the *GSM/EDGE* hotkey has a green background.

Set triggering by switching to the GSM trigger mode (See "*Trigger options*"); the level versus time over approx. 9 slots is displayed. No measurement is active.
In order to simplify the procedure for working alternately with the analyzer and GSM/EDGE modes, the principal parameters are maintained each time you change from one mode to the other:

- Center frequency (CENTER)
- Frequency offset (FREQUENCY OFFSET)
- Reference level (REF LEVEL)
- Reference level offset (REF LEVEL OFFSET)
- Attenuation value (RF ATTEN)[1]
- Mode of attenuation (RF ATTEN AUTO/MANUAL)
- Attenuation value of electronic attenuator (EL ATTEN)
- Electronic attenuator on/off (EL ATTEN OFF)[1]
- Setting of electronic attenuator (EL ATTEN AUTO/MANUAL)
- Input impedance (RF INPUT 50 Ω/75 Ω)
- Sweep counter (SWEEP COUNT = NO. OF BURSTS)
- Trigger (TRIGGER; see "*Trigger options*")

[1]) only with *RF ATTEN AUTO*: If the GSM/EDGE application is activated, the attenuation is automatically reduced so that the mixer level is at the maximum (-10dBm for FSP, -5dBm for FSU). When the GSM/EDGE application is exited, this modification is cancelled (mixer level maximum -30 dBm for FSP, -25dBm for FSU).

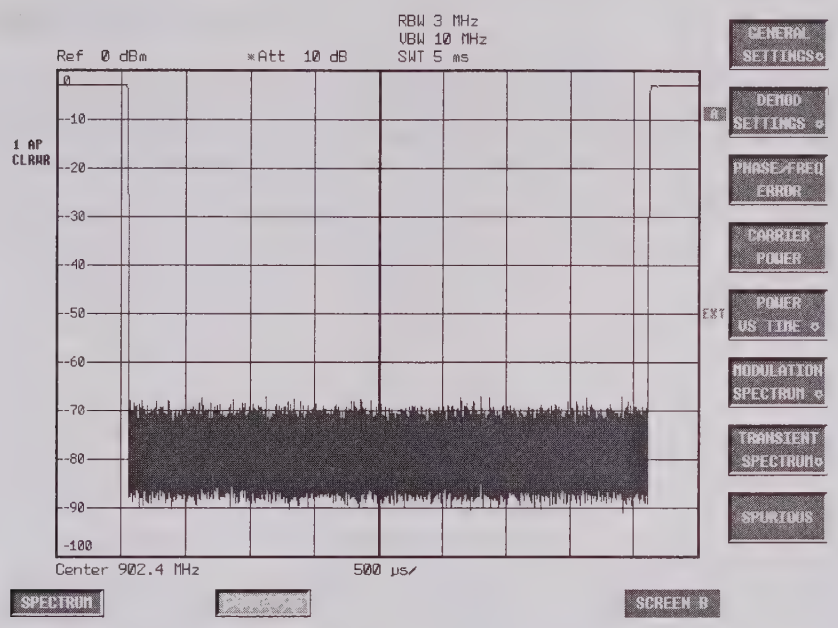


Figure 1-2 Start screen in GSM/EDGE mode

If the display does not update when you activate the GSM/EDGE mode (screen frozen), check the frequency, reduce external or internal attenuation or increase the level, or switch to an external trigger.

The application's general settings

The *GENERAL SETTINGS* menu contains the functions for setting the basic parameters needed in order to perform measurements.
All the parameters you cannot change in this menu can be controlled by means of the keys on the basic unit.
You cannot always change all the parameters for specific measurements. Availability is detailed in the descriptions of the individual measurements.

Measuring with the application

Once you exit the *GENERAL SETTINGS* menu (***PREV*** or ***GSM/EDGE***), you can start all measurements by pressing the appropriate softkey in the GSM/EDGE menu.
The PVT, MOD and TRA measurements offer a choice of modes: you can start and parameterize these modes in the submenu of the measurement you select.

The measurements of the FS-K5 may be divided into 2 classes:
Measurements with and without preceding reference measurements.

The purpose of the reference measurement – depending on the measurement selected – is to ascertain the current signal level as a reference for the subsequent (main) measurement.
This applies to all relative measurements (PVT and MOD) that require a reference value. A warning and the reference level to be set for a correctly adjusted measurement is issued at the end of the main measurement if the measured signal level is below a minimum value or above a maximum value.
Reference measurement is not automatic: it must be started manually (*START REF MEAS*).

Aborting a measurement

In manual mode you can always abort a measurement in progress.
You can do so either by pressing the softkey with which you start the measurement, or in a special dialog box where you are prompted for confirmation of your intention.
To start another measurement you always have to abort the measurement in progress.

Aborts take place without further warning.

In remote-control mode the `ABORt` command can be sent to stop a measurement in progress (see the manual on IEC/IEEE bus control).

Results of measurements

Table 1-3 Results of measurements

Measurement	Result	Limit Line	Table	Curve
PFE	Phase error 'peak' and 'RMS'; frequency error in 'Hz'. IQ offset and IQ imbalance in '%'.	None	None	X Phase error
MAC	EVM 'Peak' and 'RMS'; Origin Offset Suppression 95:th percentile frequency error in 'Hz'. IQ offset and IQ imbalance in '%'.	None	None	X EVM per symbol
CPW	PASSED / MARGIN / FAILED	Upper & lower limit lines	None	X Carrier power
PVT	PASSED / MARGIN / FAILED Carrier Power Time Trig to Sync Start	Upper & lower limit lines	None	X Carrier power
MOD Frequency sweep	PASSED / MARGIN / FAILED	Upper limit line		X Frequency sweep
MOD List	PASSED / MARGIN / FAILED	Upper limit line	One level value and one limit value per frequency value	Compressed frequency sweep while measurement is in progress
TRA Frequency sweep	PASSED / MARGIN / FAILED	Upper limit line		X
TRA List	PASSED / MARGIN / FAILED	Upper limit line	One level value and one limit value per frequency value	Compressed frequency sweep while measurement is in progress
SPU	PASSED / MARGIN / FAILED	Upper limit line		X Frequency sweep

Each measured value is assigned to one of the following quality classes:

- PASSED Best quality level — Measured values inside the tolerance window
- MARGIN : — Values inside the limit, but above the tolerance margin (= MARGIN, user-definable)
- FAILED poorest quality level — Values outside limit

Overall assessment of the measurement is shown along with the assessments of the individual measured values. The worst evaluation is dominant.

Exiting the application

You exit the FS-K5 application by pressing a hotkey to call another operating mode, for example by pressing the *SPECTRUM* hotkey to call the ANALYZER mode. The GSM/EDGE mode is no longer active, the ***GSM/EDGE*** hotkey has a grey background, the newly selected mode is active and its hotkey has a green background.
In order to simplify the procedure for working alternately with the Analyzer and GSM/EDGE modes, the principal parameters of the GSM/EDGE measurement active at the time of the changeover are maintained in the new mode:

- Center frequency (CENTER)
- Frequency offset (FREQUENCY OFFSET)
- Reference level (REF LEVEL)
- Reference level offset (REF LEVEL OFFSET)
- Attenuation value (RF ATTEN)[1]
- Mode of attenuation (RF ATTEN AUTO/MANUAL)
- Attenuation value of electronic attenuator (EL ATTEN)
- Electronic attenuator on/off (EL ATTEN OFF)[1]
- Setting of electronic attenuator (EL ATTEN AUTO/MANUAL)
- Input impedance (RF INPUT 50 Ω/75 Ω)
- Sweep counter (SWEEP COUNT = NO. OF BURSTS)
- Trigger (TRIGGER; see "*Trigger options*")
- Trigger polarity (POLARITY POS/NEG)
- Trigger offset of trigger active in GSM/EDGE (TRIGGER OFFSET)
- Resolution bandwidth [2] (RBW)
- Video bandwidth [2] (VBW)
- Sweep time [2] (SWEEP TIME)

[1]) Only with *RF ATTEN AUTO*: If the GSM/EDGE application is activated, the attenuation is automatically reduced so that the mixer level is at the maximum (max. –10 dBm for FSP, -5dBm for FSU). When the GSM/EDGE application is exited, this modification is cancelled (mixer level max. –30 dBm for FSP, -25dBm for FSU).

[2]) For CPW, MOD, TRA and SPU measurements only
These values cannot be transferred exactly in the case of the PFE and PVT measurements.
The values set for PFE and PVT are as follows:

	PFE	PVT
RBW:	300 kHz	300 kHz
VBW:	1 MHz	3 MHz
SWT:	542.75us	801.25us

Transducer factors

The FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Trigger options

For FSP, the measurements in the GSM/EDGE mode can be triggered with the IF power trigger, the external trigger, or with free run (automatic only, cannot be selected manually).
If option FSP-B6 is installed, the RF power trigger is available in addition

For FSU, the measurements in the GSM/EDGE mode can be triggered with the IF power trigger, the external trigger, or with free run (automatic only, cannot be selected manually).
The RF power trigger is not available, but its function is provided almost completely by the FSU's IF power trigger.

When the GSM/EDGE mode is called, the trigger changes from the currently active selection to a GSM trigger mode. This automatically selects a suitable trigger.

Table 1-4 Trigger options

Trigger setting before the GSM/EDGE mode is called	**GSM trigger**
IF power	IF power
RF power (FSP only)	RF power (FSP only)
Extern	External
Other trigger	IF power, The message: "IF Power Trigger active!" draws your attention to the change

The IF/RF power and/or external trigger settings are not always possible or useful in all measurements, so in some cases the FREE RUN trigger is selected automatically. The table below shows the triggers used for the various measurements and the GSM trigger mode selected.

Table 1-5 Trigger settings in GSM trigger mode

Measurement	**Possible trigger(s)**	Trigger used when trigger mode =		
		Extern	**IF Power**	**RF Power (FSP only)**
PFE	External / Free Run	External	Free Run	Free Run
CPW	External / IF Power	External	IF Power	RF Power
PVT	External / Free Run	External	Free Run	Free Run
MOD	External / IF Power	External	IF Power	RF Power
TRA	Free Run	Free Run	Free Run	Free Run
SPU	Free Run	Free Run	Free Run	Free Run

The level of the IF and RF Power trigger can be set manually.

Trigger and time references

The trigger offset for the external trigger and for the IF/RF POWER trigger can be set automatically or manually. These values are stored in the GSM/EDGE. Each time you change triggers, the relevant trigger offset value is also set.
The timeslot of the TDMA burst to be measured in the PFE, PVT, MOD and CPW measuring modes is defined in the ETSI specifications.
In the PFE and PVT measuring modes, correct timing of the timeslot is ensured by synchronization to the midamble.
In the MOD and CPW measuring modes, the timing of the timeslot has to be set precisely. The setting can be performed automatically or manually.
The manual setting is performed in the *GENERAL SETTINGS* menu by adjusting the trigger offset of the selected trigger until the TDMA burst is positioned inside the mask.
The automatic setting is performed in the *GENERAL SETTINGS* menu by means of softkey (*AUTO LEVEL & TIME*).

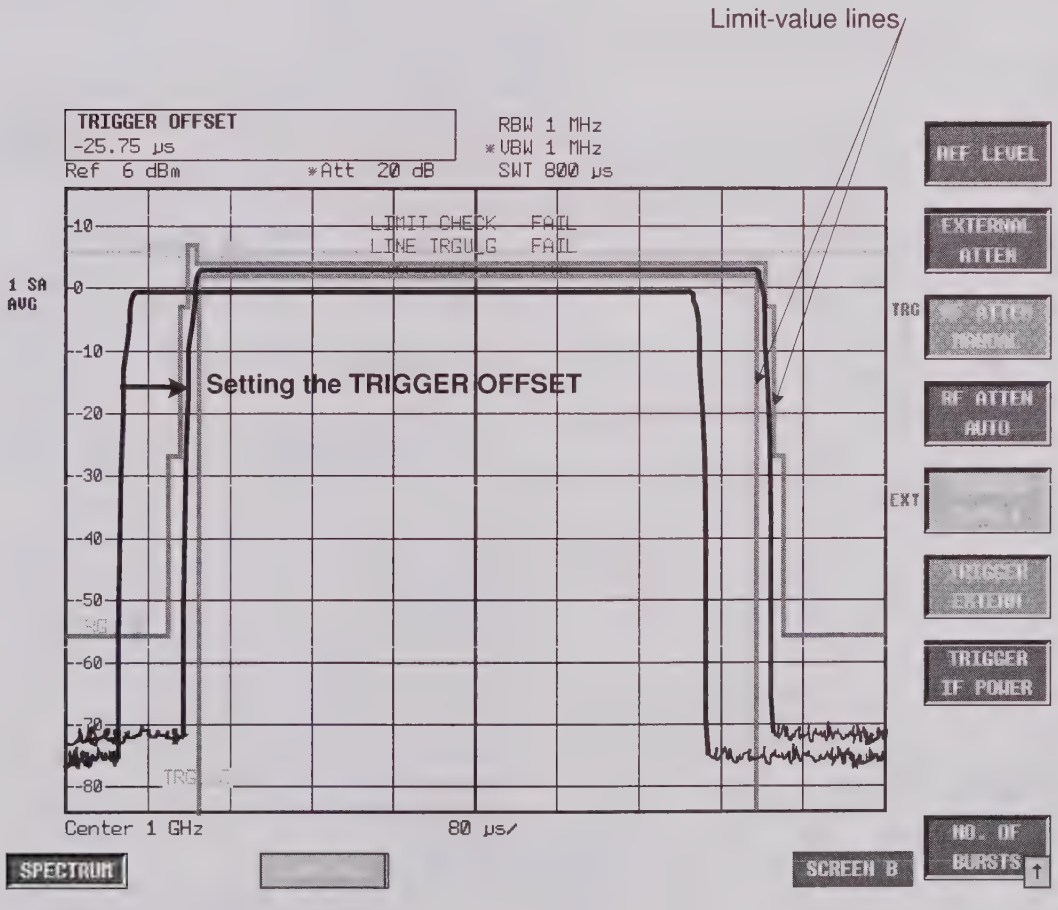


Figure 1-3 Trigger setting in *GENERAL SETTINGS* menu

Two values are computed: trigger offset and GSM/EDGE trigger offset.

Trigger offset Time between trigger and start of display.

GSM trigger offset Time between trigger and start of slot.

The value of the GSM trigger offset, in other words the time between the trigger and the start of the slot, is needed for remote control. This time is displayed when you exit the *GENERAL SETTINGS* menu or modify the Trigger.

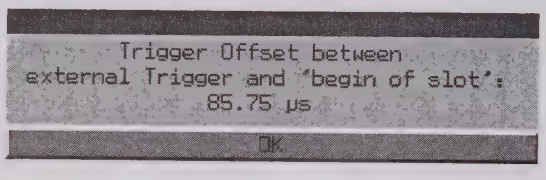


Figure 1-4 Trigger shows the trigger and time references used in the GSM firmware.

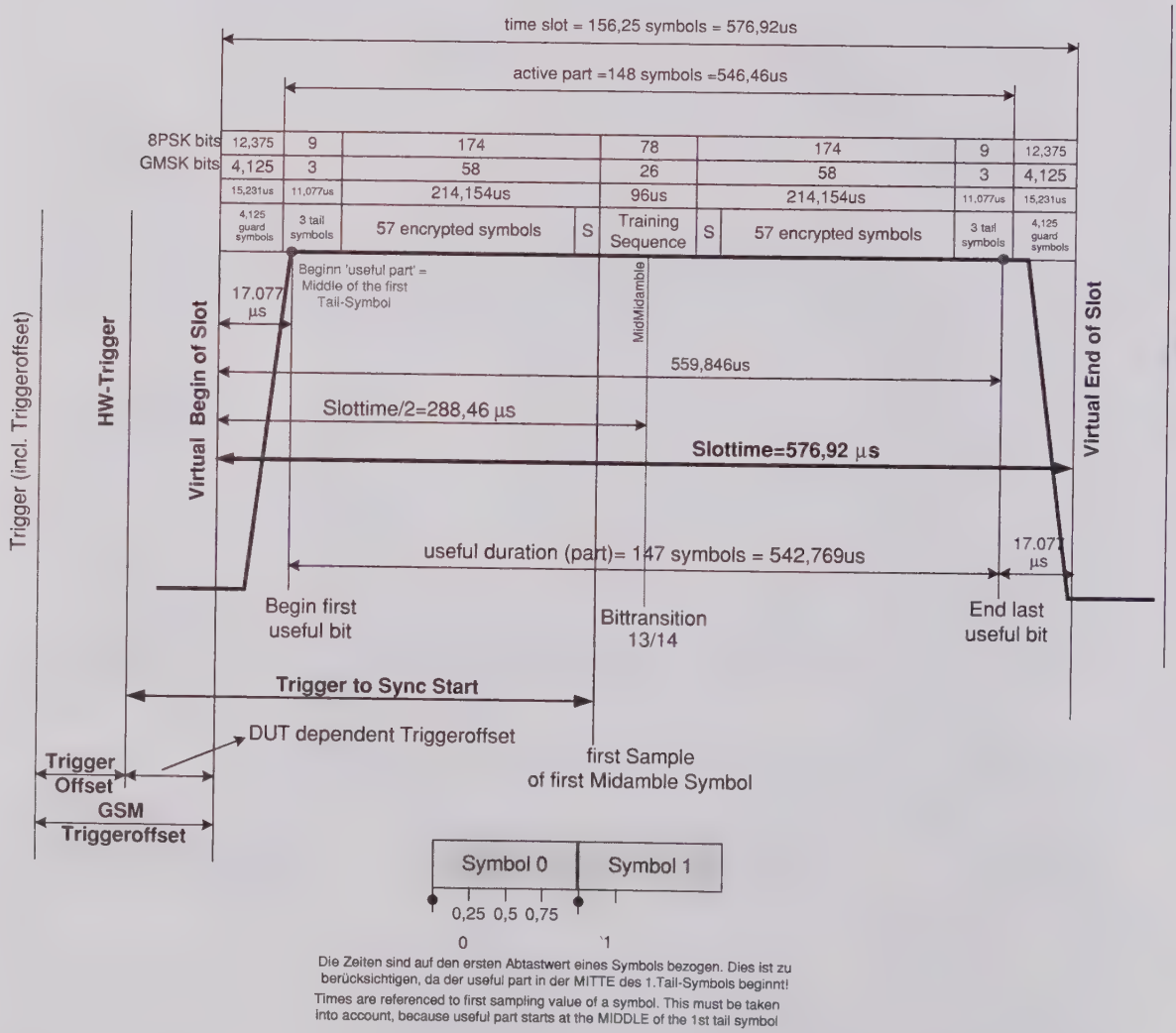

time slot = 156,25 symbols = 576,92us
active part =148 symbols =546,46us
8PSK bits 12,375 9 174 78 174 9 12,375
GMSK bits 4,125 3 58 26 58 3 4,125
15,231us 11,077us 214,154us 96us 214,154us 11,077us 15,231us
4,125 guard symbols
3 tail symbols
57 encrypted symbols
S
Training Sequence
S
57 encrypted symbols
3 tail symbols
4,125 guard symbols
Beginn 'useful part' = Middle of the first Tail-Symbol
17.077 µs
MidMidamble
559,846us
Slottime/2=288,46 µs
Slottime=576,92 µs
useful duration (part)= 147 symbols = 542,769us
17.077 µs
Trigger (incl. Triggeroffset)
HW-Trigger
Virtual Begin of Slot
Virtual End of Slot
Begin first useful bit
Bittransition 13/14
End last useful bit
Trigger to Sync Start
DUT dependent Triggeroffset
Trigger Offset
GSM Triggeroffset
first Sample of first Midamble Symbol
Symbol 0
Symbol 1
0,25 0,5 0,75
0
1
Die Zeiten sind auf den ersten Abtastwert eines Symbols bezogen. Dies ist zu berücksichtigen, da der useful part in der MITTE des 1.Tail-Symbols beginnt!
Times are referenced to first sampling value of a symbol. This must be taken into account, because useful part starts at the MIDDLE of the 1st tail symbol

Figure 1-4 Trigger and time references

Possible errors and difficulties during measurement

The three main sources of error in GSM/EDGE measurement are described below:

- **No carrier signal**

Causes:	Wrong working frequency (ARFCN), slow frequency hopping active, test line defective or wrong attenuation, wrong reference level	
Effects:	Reference measurement:	Inadequate power is measured (e.g. average measurement with slow frequency hopping), measurement issues warning. Sweep stops (measurements with midamble synchronization), warning message: Sync not found Sweep stops (measurements with IF Power trigger)
	Main measurement:	Sweep stops with midamble synchronization active (PFE, PVT) or IF Power trigger in use. Sweep resumes when signal is restored.
Remedy:	- Select correct frequency (***FREQ*** ...) - Deactivate slow frequency hopping (see "Measurements with slow frequency hopping" in the descriptions of the individual measurements) - Set correct external attenuation (*GENERAL SETTINGS\EXT ATTEN)* - Set correct reference level (*GENERAL SETTINGS \REF LEVEL* ...)	

- **No trigger**

Effects:	All triggered measurements: sweep stops. This is not immediately apparent on screen.
Remedy:	- Change trigger - IF/RF Power trigger: reduce level of IF/RF power trigger reduce external attenuation increase signal level

- **Trig. to Sync Start is not available during PVT measurement**

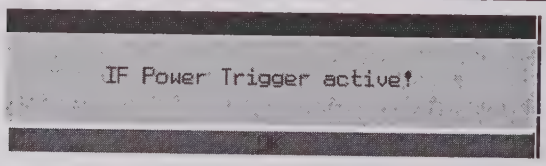
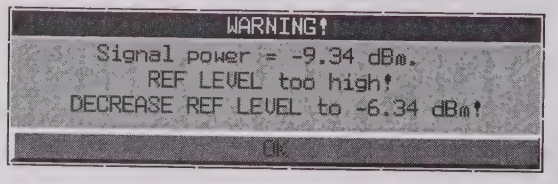
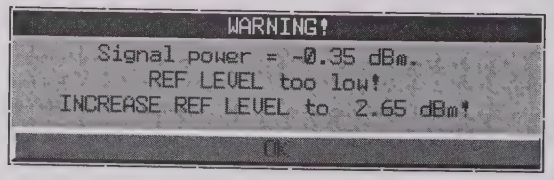
Causes:	Power-Trigger used instead of external trigger TRGS is only available with external trigger
Effects:	During PVT measurement the result display TRGS is not available
Remedy:	Change trigger to Extern

- **Burst not found/Sync not found**

Causes:	Dummy burst, slow frequency hopping active, wrong midamble, wrong modulation type
Effects:	Sweep stops (measurements with midamble synchronization)
Remedy:	Necessary only if measurement does not run, otherwise measurement is possible - Check the modulation type - Check the midamble - Deactivate slow frequency hopping

Messages in GSM/EDGE mode

All the messages explained below remain on screen only for as long as is absolutely necessary. They are cleared automatically three seconds after the reason why they were issued no longer applies. You can close any box with an 'OK button' by pressing ENTER.
You can continue to use softkeys, keys and hotkeys while a message box is displayed on screen.
If a message box includes an 'ABORT' key, you can abort the action in progress by pressing ENTER.

Message	Explanation
	- Indicates that list measurement (MOD or TRA) is in progress - Abort possible ➢ If this message remains in view and no progress in the trace is apparent on the screen, measurement might be waiting for a trigger.
	- List measurement aborted by user - Values obtained during this measurement are ignored
	- Reference measurement for PVT or MOD measurement in progress - Abort possible ➢ If this message remains in view and no progress in the trace is apparent on the screen, measurement might be waiting for a trigger.
	- Reference measurement aborted by user - Values obtained during this measurement are ignored
	- When the GSM/EDGE software is activated, this message is displayed to show that the IF Power trigger has been activated by default. ➢ See "*Trigger and time references*".
	- Indicates that the power measured in reference measurement does not correspond to the setting for the reference level (reference level is too high). ➢ Reduce the reference level to approx. the value given in the message so that the reference level is about 3 dB higher than the actual power.
	- Indicates that the power measured in reference measurement does not correspond to the setting for the reference level (reference level is too low). ➢ Increase the reference level to approx. the value given in the message so that the reference level is about 3 dB higher than the actual power .

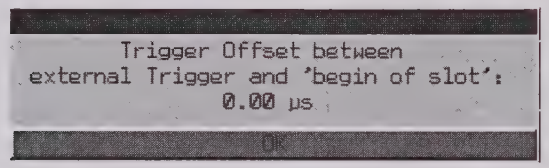
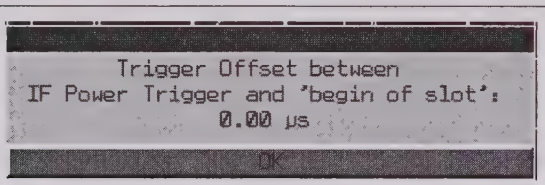
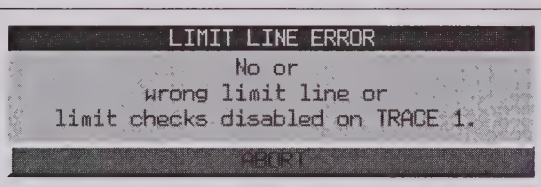
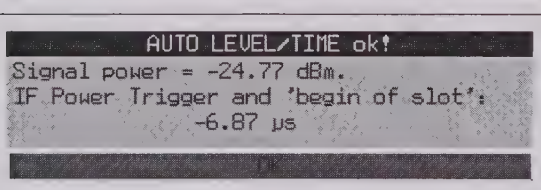
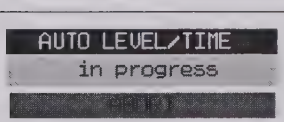
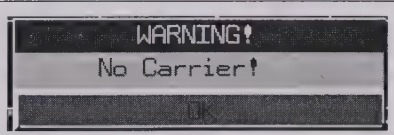
Message	Explanation
	- Indicates that the *BURST FIND* function is always on in this version (see DEMOD SETTINGS).
	- Indicates that the *SYNC FIND* function is always on in this version (see DEMOD SETTINGS).
	- Indicates the current setting for the time between the trigger (external) and the start of the slot. ➢ See "*Trigger and time references*"
	- Indicates the current setting for the time between the trigger (IF Power) and the start of the slot ➢ See "*Trigger and time references*"
	- Indicates that an expected limit line was not found or is incorrect ➢ Use the *RESTORE GSM LIMITS* softkey to restore the original GSM/EDGE limit lines, correct the limit line or switch on the Limit Checks on *TRACE 1*.
	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are completed sucessfully. Values obtained during this measurement are indicated.
	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are aborted.
	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are in progress. ➢ If the measurement stops here, check the trigger and the trigger levels.
 or "Carrier OVERLOAD"	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are aborted automatically because of a missing signal. - This error may also occur if the level at the instrument is higher than 27 dBm. In this case, the message "Carrier Overload" is output.

Table of Contents - Measurements

2 Measurements with Application Firmware FS-K5 (GSM/EDGE Base and Mobile Station Tests) 2.1

The GSM/EDGE Hotkey 2.1

Menu Overview 2.2

Selecting default settings 2.3

External reference frequency 2.3

GENERAL SETTINGS menu 2.3

DEMOD SETTINGS menu 2.8

Restoring the limit lines –RESTORE GSM LINES softkey 2.13

Setting the transmit channel 2.14

Measurement of modulation accuracy of EDGE signals 2.15

Requirements for the measuring signal 2.15

Quick reference guide 2.16

Measurement 2.17

Test hints 2.19

Number of bursts to be measured - *NO OF BURSTS* 2.19

Measuring with slow frequency hopping 2.19

Additional information 2.20

Availability of keys and softkeys 2.21

Measurement of phase and frequency error 2.22

Requirements for the measuring signal 2.22

Quick reference guide 2.22

Measurement 2.23

Test hints 2.25

Number of bursts to be measured - *NO OF BURSTS* 2.25

Measuring with slow frequency hopping 2.25

Additional information 2.26

Availability of keys and softkeys 2.27

Measurement of carrier power 2.28

Requirements for the measuring signal 2.28

Quick reference guide 2.28

Measurement 2.29

Test hints 2.30

Increase of measurement speed 2.30

Transducer factors 2.31

Number of bursts to be measured -> *NO OF BURSTS* 2.31

Measuring with slow frequency hopping 2.31

Measurement of individual power control levels and power classes 2.32
Additional information 2.33
Availability of keys and softkeys 2.34

Measurement of carrier power versus time 2.35
Requirements for the measuring signal 2.35
Quick reference guide 2.35
Measurement 2.36
Test hints 2.44
Power measurement with reference to midamble 2.44
Measuring with slow frequency hopping 2.45
Number of bursts to be measured -> *NO OF BURSTS* 2.45
Measurement with maximum dynamic range 2.45
Increasing the measurement speed during remote control 2.46
Additional information 2.48
Availability of keys and softkeys 2.49

Measurement of spectrum due to modulation 2.50
Requirements for the measuring signal 2.50
Multislot Measurements 2.50
Quick reference guide 2.51
Measurement 2.52
Test hints 2.58
Increasing measurement speed 2.58
Transducer factors 2.61
Measuring with slow frequency hopping 2.61
Number of bursts to be measured -> *NO OF BURSTS* 2.61
Additional information 2.62
Availability of keys and softkeys 2.64

Measurement of spectrum due to transients 2.65
Requirements for the measuring signal 2.65
Quick reference guide 2.65
Measurement 2.66
Test hints 2.72
Measuring with slow frequency hopping 2.72
Increasing measurement speed 2.72
Optimizing the Sweep Time 2.73
Transducer factors 2.73
Number of bursts to be measured -> *NO OF BURSTS* 2.73
Additional information 2.74
Availability of keys and softkeys 2.76

Measurement of spurious 2.77
Requirements for the measuring signal 2.77
Quick reference guide 2.77

Measurement 2.78

Test hints 2.79
Number of bursts to be measured -> *NO OF BURSTS* 2.79
Transducer factors 2.79

Additional information 2.80

Availability of keys and softkeys 2.81

Figures

Figure 2-1 Starting and exiting the application 2.1
Figure 2-2 Overview of menus 2.2
Figure 2-3 Setting trigger offset and reference level with graphic support 2.4
Figure 2-4 Measurement of Modulation Accuracy 2.18
Figure 2-5 Measurement of phase and frequency error 2.24
Figure 2-6 Measurement of carrier power 2.29
Figure 2-7 PVT single slot measurement – FULL BURST 2.37
Figure 2-8 PVT multi slot measurement – FULL BURST, 4 slots active 2.38
Figure 2-9 PVT measurement – RISING EDGE 2.39
Figure 2-10 PVT measurement – FALLING EDGE 2.40
Figure 2-11 PVT measurement – TOP HIGH RESOLUTION 2.41
Figure 2-12 Spectrum due to modulation in frequency domain 2.53
Figure 2-13 Time domain measurement in progress 2.55
Figure 2-14 Results of time domain measurement 2.55
Figure 2-15 Spectrum due to transients in frequency domain 2.67
Figure 2-16 Time domain measurement in progress 2.69
Figure 2-17 Results of time domain measurement 2.69
Figure 2-18 Measurement of spurious 2.78

Tables

Table 2-1 Relationship between frequencies and channels 2.14
Table 2-2 Power classes 2.32
Table 2-3 Power control levels 2.32
Table 2-4 Power classes 2.44
Table 2-5 Power control level 2.44

2 Measurements with Application Firmware FS-K5 (GSM/EDGE Base and Mobile Station Tests)

The following measurements are possible with the FS-K5 application firmware in single slot or multi slot mode:

• PFE	Phase-frequency error	Measurement of phase and frequency error with synchronization to midamble, IQ offset and IQ imbalance
• MAC	Modulation Accuracy	Measurement of EVM, of 95:th percentile value, origin offset suppression, of frequency error, of IQ offset and IQ imbalance with synchronization to midamble
• CPW	Carrier power	Measurement of carrier power
• PVT	Power versus time	Measurement of carrier power versus time with synchronization to midamble
• MOD	Modulation spectrum	Measurement of spectrum due to modulation
• TRA	Transient spectrum	Measurement of spectrum due to transients
• SPU	Spurious	Measurement of spurious

Midamble: A standard midamble or an user defined midamble can be selected.

The GSM/EDGE Hotkey

Pressing the *GSM/EDGE* hotkey calls the application. A menu compliant with the applicable standards is displayed, with a measurement assigned to each softkey. The *GENERAL SETTINGS* and *DEMOD SETTINGS* contain the functions for setting default values.

There are **two** situations in which the ***GSM/EDGE***hotkey can be pressed:

1) The GSM/EDGE mode is **not** active, the ***GSM/EDGE***hotkey has a grey background:

   ➢ Pressing the ***GSM/EDGE*** hotkey starts the GSM/EDGE application and opens the main menu of the FS-K5.
   At the same time the display changes to Zero Span and the trigger changes to the GSM trigger.

2) The GSM/EDGE mode is active, the ***GSM/EDGE*** hotkey has a green background:

   Most of the keys of the device are operational, so you can exit the GSM/EDGE menu by pressing a key. The GSM/EDGE mode remains active. Press the GSM/EDGE hotkey to return to the GSM/EDGE main menu.

   ➢ Pressing the ***GSM/EDGE*** hotkey opens the FS-K5 main menu.
   The measurements continue. All user-modified parameter settings are retained.

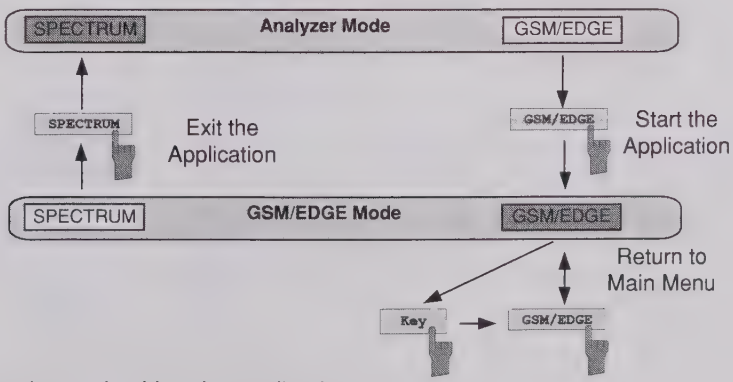
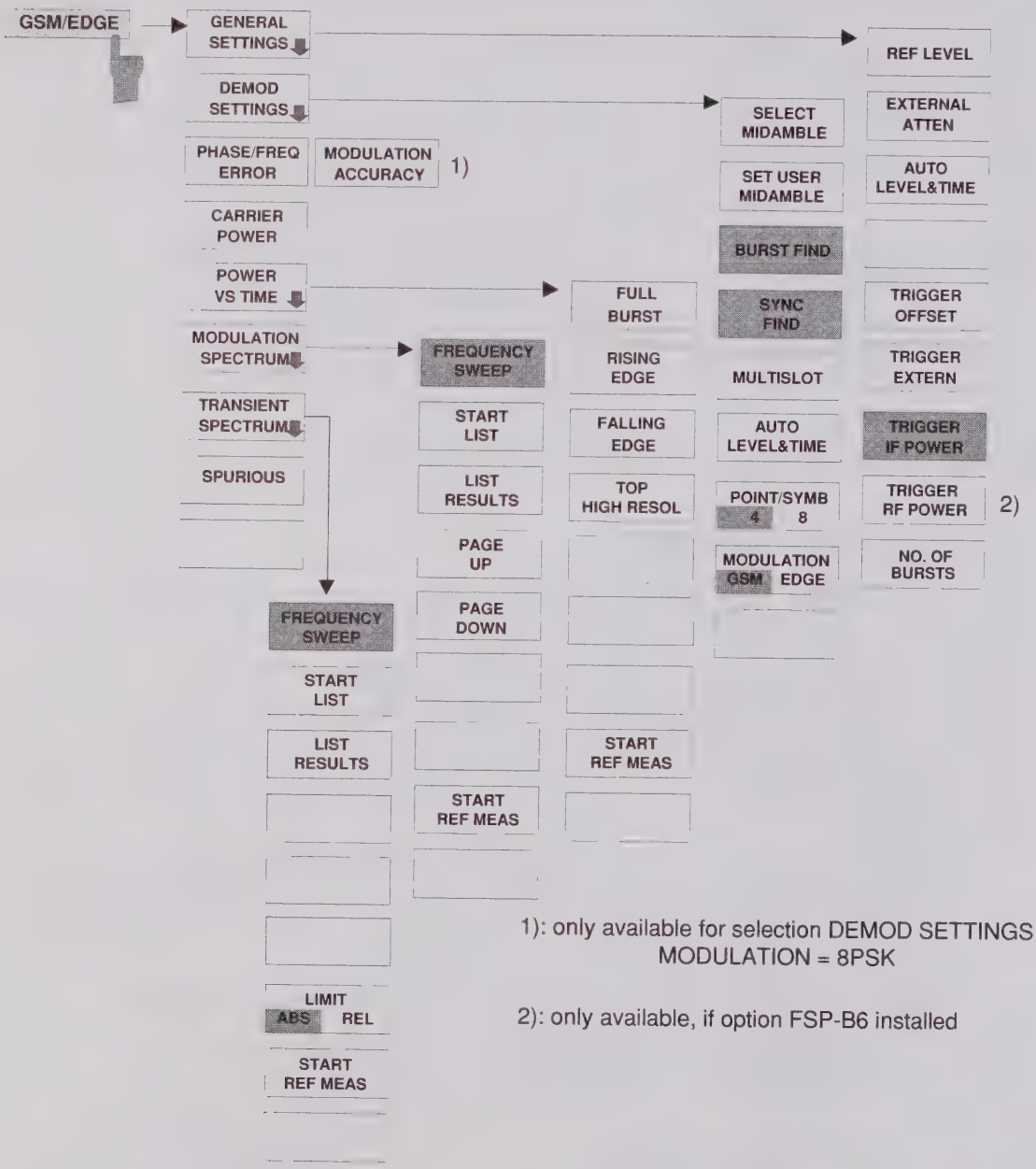


Figure 2-1 Starting and exiting the application

Menu Overview



1): only available for selection DEMOD SETTINGS MODULATION = 8PSK

2): only available, if option FSP-B6 installed

Figure 2-2 Overview of menus

Selecting default settings

External reference frequency

Depending on whether or not the mobile station can be set to a service mode or whether another device (CMD, CMU) "calls" the mobile, it may be necessary to synchronize the reference frequencies of the devices in use.
This is particularly important before measuring the phase/frequency error or the carrier power.
The procedure for switching to an external reference frequency is the same as in the basic unit.

SETUP menu:

Press the *REFERENCE INT / EXT* softkey to toggle between the internal and the external reference sources.

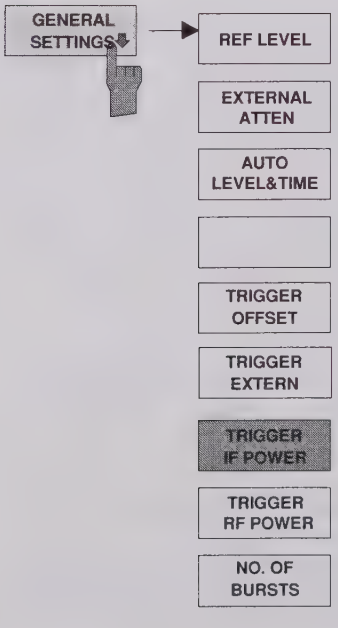
Notes: *If you toggle to external reference and the reference signal is not present, the word "EXREF" is displayed to indicate that synchronization has not been achieved.*

When switching to the internal reference, it is important to ensure that the external reference signal has been disconnected, in order to avoid undesirable interaction with the internal reference signal.

IEC/IEEE bus command: `ROSC:SOUR INT`

GENERAL SETTINGS menu

GSM/EDGE menu



Pressing the *GENERAL SETTINGS* softkey opens a submenu for setting the major parameters of the GSM/EDGE base and mobile station tests application.

When you open this menu the burst mask is displayed, offering graphic support for setting the reference level and the trigger offset. The burst mask corresponds to the PVT limit lines. In order for measurement to be correct, the GSM/EDGE signal burst must be positioned between these lines automatically or manually (see Figure 2-3 and the descriptions of the *REF LEVEL TRIGGER OFFSET* and *AUTO LEVEL & TIME* softkeys).

This submenu offers the only opportunity of setting the reference level (REF LEVEL) and the trigger settings for the application with graphic support.

The *AUTO LEVEL & TIME* softkey enables the automatic setting of the reference level and trigger offset for the active GSM trigger.

The *TRIGGER RF POWER* softkey is available with option FSP-B6 (TV and RF trigger) only.

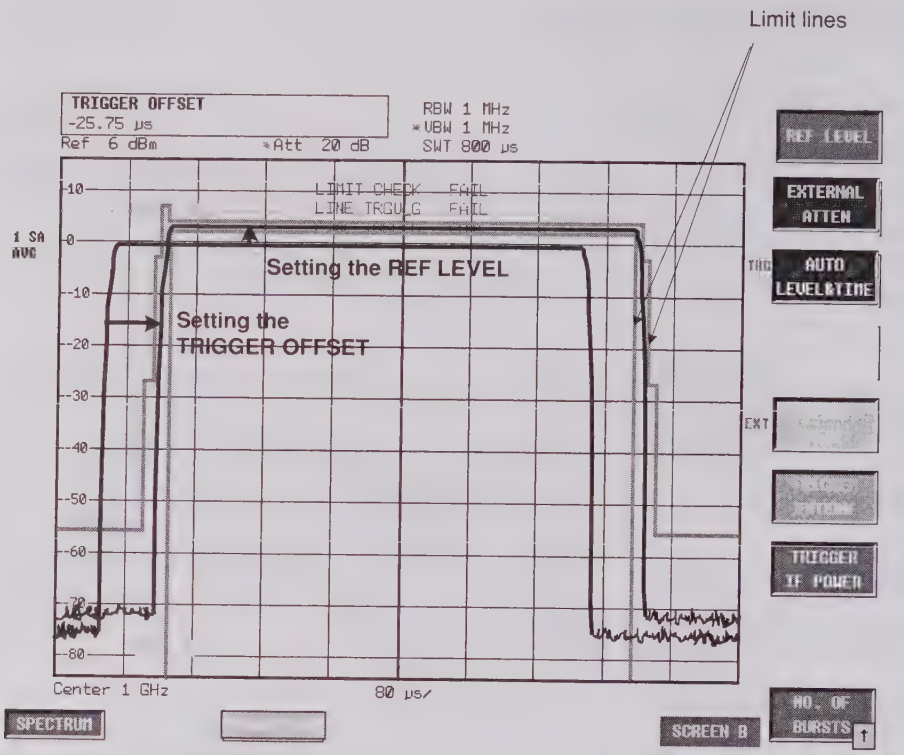


Figure 2-3 Setting trigger offset and reference level with graphic support

REF LEVEL

The *REF LEVEL* softkey activates the input of the reference level.

You can adjust the reference level graphically by turning the spinwheel so that the useful part of the burst is between the two horizontal limit lines.
Graphic adjustment takes into account the fact that the reference level must be approx. 3 dB higher than the power of the mobile station. This is the reason why the burst mask is 3 dB below the reference level. This protects the analyzer against overload.

In all other respects the effect of the softkey is the same as that of the *REF LEVEL* in the *AMPT* menu of the spectrum analyzer in the Analyzer mode.

IEC/IEEE bus command `DISP:TRAC2:Y:RLEV -130dBm to 30dBm`

EXTERNAL ATTEN

The *EXTERNAL ATTEN* softkey activates the input of external attenuation.

The attenuation is taken into account when the level reading is corrected. All measured levels and the gradations on the Y axis of the measured-value diagram are shifted by the selected correction value.

Note: *It is recommended to automatically adjust the reference level and the trigger offset using softkey AUTO LEVEL & TIME.*

The effect of the softkey is the same as that of entering a level offset with the *REF LEVEL OFFSET* softkey in the *AMPT* menu of the spectrum analyzer in the Analyzer mode.

IEC/IEEE bus command `DISP:TRAC2:Y:RLEV:OFFS <num_value>`

The *AUTO LEVEL & TIME* softkey automatically sets the trigger offset and the reference level.
If necessary, the IF or RF trigger level and the setting of the mechanical and (if available) electronic attenuator are optimized in addition.

The following parameters must be correctly set **before** this auto function is started:

- center frequency
- GSM trigger mode
- modulation mode
- multislot settings
- midamble

During the *AUTO LEVEL & TIME* measurement, the signal level is measured and the reference level is set to 3 dB above the measured signal level. After a successful measurement, the signal power and the trigger level are indicated.

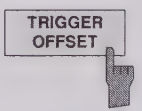
If the measurement is not successfully completed (termination by the user or as a result of a "Carrier Overload" error (more than +27 dBm) or "No Carrier" error), the trigger offset and reference level settings are not changed.

During the *AUTO LEVEL & TIME* measurement, the attenuation is set to *AUTO* and the trigger slope to *POSITIVE* (for IF-Power trigger only). After the measurement, the user defined settings are restored.

In the course of the *AUTO LEVEL & TIME* measurement, the premeasurement for PVT is performed. It is not necessary to repeat this premeasurement after a successful *AUTO LEVEL & TIME* measurement. The premeasurement for MOD, however, has to be performed separately because it uses a different measurement bandwidth.

If automatic setting is not successful, the settings must be made manually with the *REF LEVEL* and *TRIGGER OFFSET* softkeys.

IEC/IEEE bus command `READ:AUTO:LEVTime?`



The *TRIGGER OFFSET* softkey activates the manual input of the trigger offset (time between trigger and start of display).

The trigger offset can be adjusted graphically by turning the spinwheel so that the burst is within the vertical limit lines (see Figure 2-3).

Note: *It is recommended to automatically adjust the trigger offset and the reference level using softkey AUTO LEVEL & TIME.*

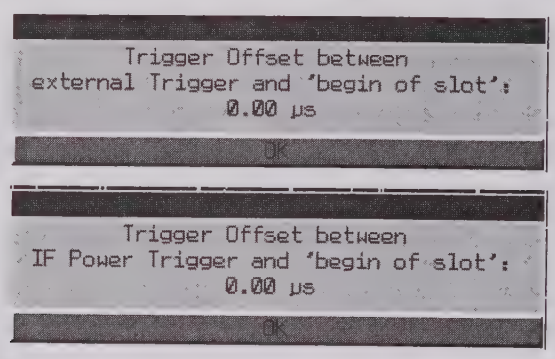
A trigger-offset value is saved for the external GSM trigger and another for the GSM trigger IF Power. This means:

When GSM-Trigger Extern is active, you can press the *TRIGGER OFFSET* softkey to set the offset of the external trigger.

When GSM-Trigger IF Power is active, you can press the *TRIGGER OFFSET* softkey to set the offset of the IF Power trigger.

When you change the trigger, the offset belonging to the trigger is activated at the same time.

When you exit the trigger-offset function, a status window appears showing the GSM trigger offset (time between trigger and start of slot) needed for remote control. The time references are described in Chapter 1, "Trigger options".



Note: *The values determined here for the GSM trigger offset must be specified in remote-control mode for correct synchronization with the* `TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal,` `TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower or` `TRIGger[:SEQuence]:SYNChronize:ADJust RFPower` *commands.*

IEC/IEEE bus command-- `(the GSM trigger offset must be specified in remote-control mode)`

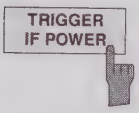
The *TRIGGER EXTERN* softkey switches on the external GSM trigger.

Triggering is either by an external trigger (PFE, CPW, PVT, MOD) or by a free-running trigger (TRA, SPU), see Chapter 1, "Trigger options".

When the external trigger is used triggering is by a TTL signal at the *EXT TRIGGER/GATE* input at the rear of the device.

Note: *In remote-control mode the GSM trigger offset has to be entered at the same time as the GSM trigger is selected.*

IEC/IEEE bus command `TRIG:SYNC:ADJ:EXT -460µs to 100s`



The *TRIGGER IF POWER* softkey switches on the IF Power GSM trigger and activates the input for the IF trigger level.

Triggering is either by the IF Power trigger (CPW, MOD) or by a free-running trigger (PFE, PVT, TRA, SPU), see Chapter 1, "Trigger options".

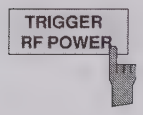
When the IF Power trigger is used, triggering is by signals in a bandwidth of approx. 10 MHz (FSP) or 40 MHz (FSU) around the center frequency, where they exceed an adjustable level value.

To this end, the spectrum analyzer employs a level detector on the third intermediate frequency. This threshold can be adjusted and is preset to approx. -20 dBm of the level at the input connector (for detailed description see manual of basic instrument).

The bandwidth on the intermediate frequency is nearly 10 MHz (FSP) or nearly 40 MHz (FSP). Triggering occurs when the trigger threshold is exceeded within 10/40 MHz of the defined frequency (= start frequency in frequency sweep).

Note: *In remote-control mode the GSM trigger offset has to be entered at the same time as the GSM trigger is selected.*

IEC/IEEE bus command `TRIG:SYNC:ADJ:IFP -460µs to 100s`



The *TRIGGER RF POWER* softkey switches on the RF Power GSM trigger and activates the input for the RF trigger level.

This softkey is only available for FSP with option FSP-B6 installed.

Triggering is either by the RF Power trigger (CPW, MOD) or by a free-running trigger (PFE, PVT, TRA, SPU), see Chapter 1, "Trigger options".

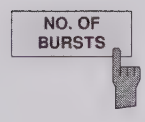
When the RF Power trigger is used, triggering is by signals in a bandwidth of approx. 40 MHz around the center frequency, where they exceed an adjustable level value.

To this end, the spectrum analyzer employs a level detector on the second intermediate frequency. This threshold can be adjusted and is preset to approx. –40 dBm of the level at the input connector (for detailed description see manual of basic instrument).

The bandwidth on the intermediate frequency is 80 MHz. Triggering occurs when the trigger threshold is exceeded within 80 MHz of the defined frequency (= start frequency in frequency sweep).

Note: *In remote-control mode the GSM trigger offset has to be entered at the same time as the GSM trigger is selected.*

IEC/IEEE bus command `TRIG:SYNC:ADJ:RFP -460µs to 100s`



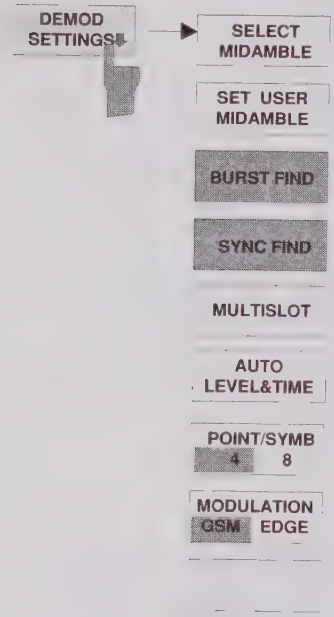
Press the *NO. OF BURSTS* softkey to activate input of the number of bursts to be taken into account in calculation.

The effect of the softkey is the same as that of the *SWEEP COUNT* softkey in the *SWEEP* menu of the spectrum analyzer in the Analyzer mode.

IEC/IEEE bus command `SENS:SWEep:COUNt 0 to 32767`

DEMOD SETTINGS menu

GSM/EDGE menu:

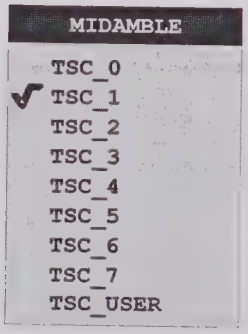


Pressing the *DEMOD SETTINGS* softkey opens a submenu for setting the major parameters of the demodulator in the GSM/EDGE application.

These parameters cannot be set in the Analyzer mode of the spectrum analyzer.

Press the *SELECT MIDAMBLE* softkey to open a picklist for selecting the midamble.

Use this softkey to specify the midamble to be used for GSM/EDGE measurements with demodulation (PFE and PVT).
The user has a choice of 8 GSM or EDGE standard training sequences or an user defined training sequence (TSC_USER).



TSC bit pattern for GMSK

NAME	PATTERN (Bit no.: 61 - 86)	HexCode
TSC_0	00 1001 0111 0000 1000 1001 0111	x0970897
TSC_1	00 1011 0111 0111 1000 1011 0111	x0b778b7
TSC_2	01 0000 1110 1110 1001 0000 1110	x10ee90e
TSC_3	01 0001 1110 1101 0001 0001 1110	x11ed11e
TSC_4	00 0110 1011 1001 0000 0110 1011	x06b906b
TSC_5	01 0011 1010 1100 0001 0011 1010	x13ac13a
TSC_6	10 1001 1111 0110 0010 1001 1111	x29f629f
TSC_7	11 1011 1100 0100 1011 1011 1100	x3bc4bbc

TSC bit pattern for EDGE

NAME	PATTERN (Bit no.: 61 - 86)
TSC0	001001 111001001111 001111111111 001001001001 111001001001 111001001111 001111111111
TSC1	001001 111001111111 001111111111 001111111111 111001001001 111001111111 001111111111
TSC2	001111 001001001001 111111111001 111111111001 111001001111 001001001001 111111111001
TSC3	001111 001001001111 111111111001 111111001111 001001001111 001001001111 111111111001
TSC4	001001 001111111001 111001111111 111001001111 001001001001 001111111001 111001111111
TSC5	001111 001001111111 111001111001 111111001001 001001001111 001001111111 111001111001
TSC6	111001 111001001111 111111111111 001111111001 001001111001 111001001111 111111111111
TSC7	111111 111001111111 111111001001 001111001001 111001111111 111001111111 111111001001

The bit pattern for EDGE results from the symbol pattern for EDGE using the following transformation:

SYMBOL	PATTERN
0	111
1	011
2	010
3	000
4	001
5	101
6	100
7	110

IEC/IEEE bus command `CONFigure:CHANnel:TSC 0...7 | USER`

The *SET USER MIDAMBLE* softkey activates the input of an user specific midamble.

The midamble is entered bit by bit (GMSK: 1bit/symbol, 8PSK: 3 bits/symbol). The only admissible values are 1 and 0. Values other than 0 or 1 are set to 1.

Input fields that are not completely filled are filled with 0, inputs that are too long are cut off. If this is the case, a message appears that has to be confirmed by means of ENTER.

The midamble for EDGE (8PSK) is entered in two successive fields. The first 40 bits are entered in the first field, the remaining 38 bits in the second field . If the input of data into the second field is aborted by means of ESC/CANCEL, the data in the first field are nevertheless accepted by the instrument.

The user midamble is stored separately for each modulation type. It is set to 0 only when the instrument is switched off or when PRESET is activated.

IEC/IEEE bus command `CONFigure:CHANnel:TSC:USER <string>`

BURST FIND

Press the *BURST FIND* softkey to see whether the BURST FIND mode is active.

When this mode is active, the GSM/EDGE measurement software presumes that a burst has been found. A burst is considered found when the burst level is greater than half of the maximum burst level in a frame.

The burst length must moreover be between 140 and 170 symbols.

The BURST FIND mode is always active. A message box brings this to the user's attention.

IEC/IEEE bus command –

SYNC FIND

Press the *SYNC FIND* softkey to see whether the SYNC FIND mode is active.

When this mode is active, the GSM/EDGE measurement software presumes that the midamble found corresponds to the preset TSC.

The SYNC FIND mode is always active. A message box brings this to the user's attention.

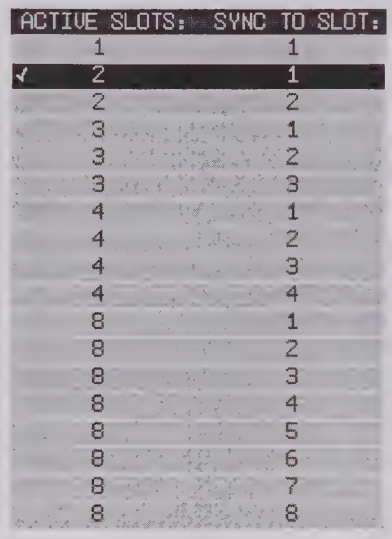
IEC/IEEE bus command –

MULTISLOT

The *MULTISLOT* softkey opens a table for selecting the multi slot configuration.

In column ACTIVE SLOTS, the number of active slots is set.
In column SYNC TO SLOT, the slot is specified

a, to be used to synchronize on it (for GSM measurements with demodulation (PFE and PVT))
b, or to be measured (for GSM measurements without demodulation (CPW, MOD) .



ACTIVE SLOTS:	SYNC TO SLOT:
1	1
✓ 2	1
2	2
3	1
3	2
3	3
4	1
4	2
4	3
4	4
8	1
8	2
8	3
8	4
8	5
8	6
8	7
8	8

The midamble set under *SELECT MIDAMBLE* must be the same as the midamble of the slot selected in the SYNC TO SLOT column.

Also the limit lines will be adapted if the number of active slots is changed.

Example 1: - 2 slots active
- the PFE measurement should be made for the **first** slot
-> ACTIVE SLOTS = 2, SYNC TO SLOT = 1
see figure above

Example 2: - 2 slots active
- the PFE measurement should be made for the **second** slot
-> ACTIVE SLOTS = 2, SYNC TO SLOT = 2

Example 3: - 3 slots active
- the PVT measurement should be synchronized to the **third** slot
-> ACTIVE SLOTS = 3, SYNC TO SLOT = 2

Example 4: - 3 slots active, EDGE/GSM/EDGE
- the MAC measurement should be made for the **second EDGE** slot (=slot 3)
-> ACTIVE SLOTS = 3, SYNC TO SLOT = 3

IEC/IEEE bus command

```
CONFigure:CHANnel:SLOT:MULTi ACT1SYNC1
```

The measurements can be optimized by varying the parameters listed above. See the description of the individual measurements (MOD and TRA).

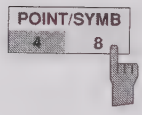
The *AUTO LEVEL & TIME* softkey automatically sets the trigger offset and the reference level.
If necessary, the IF or RF trigger level and the setting of the mechanical and (if available) electronic attenuator are optimized in addition.

If the measurement is not completed successfully (termination by user or as a result of an error), no setting is changed.

The following parameters must be correctly set **before** this auto function is started:
- center frequency
- GSM trigger mode
- modulation mode
- multislot settings
- midamble

If automatic setting is not successful, make the settings manually with the *REF LEVEL* and *TRIGGER OFFSET* softkeys.

IEC/IEEE bus command `READ:AUTO:LEVTime?`

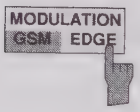


The *POINT/SYMB* softkey switches the resolution for PFE/PVT/MAC measurements between 4 and 8 points per analyzed symbol.

This settings does not influence the CPW/MOD/TRA/SPU measurements.

For POINT/SYMB = 8, twice the amount of data is processed. As a result, the resolution for the PFE/MAC/PVT measurements increases. The measurement speed, however, decreases because of longer computing times. The data can be retrieved by using the *TRACE ASCII EXPORT* function of the basic unit or by using the remote control command `TRAC:DATA? TRACE1`.

IEC/IEEE-bus command: `CONFigure:PRATe 4 | 8`



The *MODULATION GSM / EDGE* softkey selects the modulation type. The limit lines are adapted to the selected modulation type upon switchover.

IEC/IEEE bus command `CONFigure:MTYPe GMSK | EDGE`

Restoring the limit lines –RESTORE GSM LINES softkey

LINES menu

Press the *RESTORE GSM LINES* softkey to reset all the limit lines of the GSM/EDGE application to their default values.
This softkey appears in the LINES menu of the spectrum analyzer as soon as the GSM/EDGE application is enabled.

Users have the option of adjusting the limit lines to suit their purposes. These custom settings are retained in a preset. They are not overwritten until the user explicitly presses the *RESTORE GSM LINES* softkey.

User-defined limit lines can be protected against being overwritten when the *RESTORE GSM LINES* softkey is pressed by assigning them names other than those of the GSM/EDGE limit lines.

IEC/IEEE bus command `CONFigure:RESTore`

Note: *In remote-control mode the names of the limit lines are predefined and cannot be changed. Users must assign the limit lines these names before using them:*

Example:

```
CALCulate1:LIMit1:NAME 'PVTU_G'
where    PVT = measurement (PVT / CPW / MOD /TRA)
         U   = Upper limit line (Upper / Lower)
         _G  = modulation type (GMSK / EDGE)
```

Setting the transmit channel

The operating frequency is defined - as usual in spectrum analyzer – by pressing the *FREQ* key.

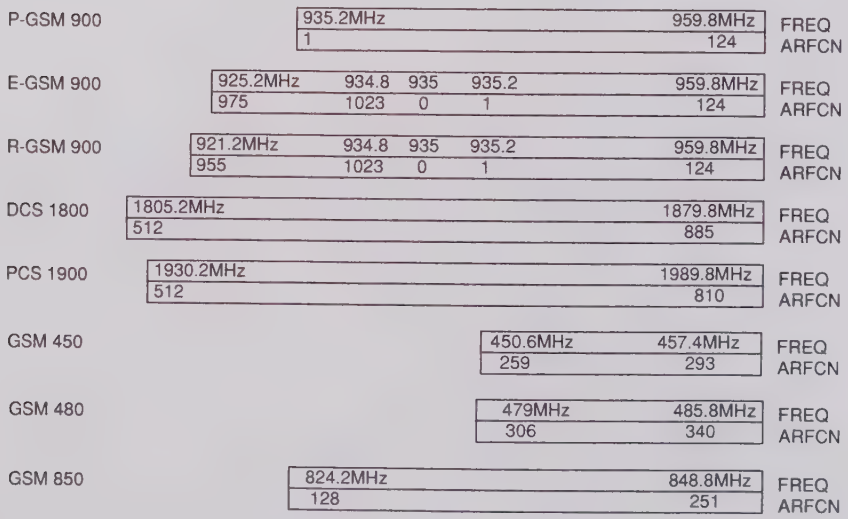
Press the *FREQ* key to open the box for manual input of the center frequency.

IEC/IEEE bus command `FREQ:CENT 100MHz`

The relationships between channel number and frequency as specified in the standards are shown below.

Table 2-1 Relationship between frequencies and channels

P-GSM 900	Fl(n) = 890 + 0.2*n	1 ≤ n ≤ 124	Fu(n) = Fl(n) + 45
E-GSM 900	Fl(n) = 890 + 0.2*n	0 ≤ n ≤ 124	Fu(n) = Fl(n) + 45
	Fl(n) = 890 + 0.2*(n-1024)	975 ≤ n ≤ 1 023	
R-GSM 900	Fl(n) = 890 + 0.2*n	0 ≤ n ≤ 124	Fu(n) = Fl(n) + 45
	Fl(n) = 890 + 0.2*(n-1024)	955 ≤ n ≤ 1023	
DCS 1 800	Fl(n) = 1710.2 + 0.2*(n-512)	512 ≤ n ≤ 885	Fu(n) = Fl(n) + 95
PCS 1 900	Fl(n) = 1850.2 + .2*(n-512)	512 ≤ n ≤ 810	Fu(n) = Fl(n) + 80
GSM 450	Fl(n) = 450.6 + .0.2*(n-259)	259 ≤ n ≤ 293	Fu(n) = Fl(n) + 10
GSM 480	Fl(n) = 479 + .0.2*(n-306)	308 ≤ n ≤ 340	Fu(n) = Fl(n) + 10
GSM 850	Fl(n) = 824.2 + .0.2*(n-128)	128 ≤ n ≤ 251	Fu(n) = Fl(n) + 45



Measurement of modulation accuracy of EDGE signals

The modulation accuracy of 8PSK modulated signals is characterized by the following quantities:

Error vector magnitude (EVM)	The error vector magnitude is the magnitude of the error vector that links the measured I and Q values at the complex level to the ideal I and Q values at the decision points. During the measurement the EVM of each of the 142 stipulated symbols of a normal burst is determined, displayed and compared to the limit values according to GSM 05.05 and GSM 11.21. The RMS value and the peak EVM are evaluated.
Origin offset suppression	The origin offset suppression (or the IQ offset) is indicated as a measure of carrier suppression. According to the standard this value is given in dB. This measurement is to verify that a defined minimum suppression is reached, so the lowest suppression value measured is stored as "HLD" (Min Hold) value. In addition, the IQ offset is given in %.
95^{th} percentile	The 95:th percentile is a statistical value describing EVM. It expresses the value not attained in 95%, or exceeded in 5%, of all cases.
Frequency error	The frequency error is the difference between the measured frequencies from the expected frequencies. The frequency error is computed from the phase of the symbols in accordance with the standards; this frequency error is also displayed.

In addition, the IQ imbalance is given in %.

For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

Requirements for the measuring signal

- At least one slot must be active and isolated, because this is the only way of reliably detecting a burst (irrespective of edge steepness) (this applies only if multislot is off, i.e. active slots = sync to slot = 1)
- Sync sequence must be present in the timeslot to which synchronization is to be made

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	**Operation**
Set frequency	*FREQ* key
Start application	*GSM/EDGE* hotkey
Select modulation type *EDGE*	Softkey *DEMOD SETTINGS* Softkey *MODULATION EDGE*
Set midamble Default: TSC0	*DEMOD SETTINGS* softkey *SELECT MIDAMBLE* softkey
Select GSM trigger Default: IF Power	*TRIGGER EXTERN* or *IF POWER* softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey (recommended) or *REF LEVEL* softkey → Position burst in mask
Start measurement	Hotkey *PREV* Softkey *MODUALTION ACCURACY*

Measurement

GSM/EDGE menu

The *MODULATION ACCURACY* softkey starts the measurement of the modulation accuracy in accordance with the standard (see Figure 2-4).

The overview of the numeric modulation errors is shown on the screen. The error is calculated over the 147 useful bits without tail bits (ie over 142 symbols).

The EMV value of each symbol is calculated and displayed as trace. The following values are then calculated and displayed:

PEAK HLD: Peak value of the EVM, calculated over 142 bits * *NO OF BURST.*

PEAK AVG: Average of the peak value of EVM per burst calculated over the number of bursts defined by *NO OF BURSTS.*

RMS HLD: Maximum value of the RMS value of the EVM, calculated over 142 bits * *NO OF BURSTS.*

RMS AVG: Average of the RMS value of EVM per burst calculated over the number of bursts defined by *NO OF BURSTS.*

FREQ HLD: Peak value of the magnitude of the frequency error, calculated over 142 bits * *NO OF BURSTS.*

FREQ AVG: Average of the frequency error calculated over the number of bursts defined by *NO OF BURSTS.*

OOS HLD: Peak value of the Origin Offset Suppression, calculated over 142 bits * *NO OF BURSTS.*

OOS AVG: Average of the maximum Origin Offset Suppression value per burst calculated over the number of bursts defined by *NO OF BURSTS.*

PERC HLD: Peak value of the 95:th percentile value, calculated over 142 bits * *NO OF BURSTS.*

PERC AVG: Average of the PERC value per burst calculated over the number of bursts defined by *NO OF BURSTS.*

IQOF HLD: Peak value of IQ offset, calculated over 142 bits * *NO OF BURSTS*

IQOF AVG: Average of the maximum IQ offset per burst calculated over the number of bursts defined by *NO OF BURSTS*

IQIM HLD: Peak value of IQ imbalance, calculated over 142 bits * *NO OF BURSTS*

IQIM AVG: Average of the maximum IQ imbalance per burst, calculated over the number of bursts defined by *NO OF BURSTS*

These readings can be switched on and off in ***MEAS*** / *TIME DOM POWER.*

The EVM value versus time within the 142 bits of the normal burst is shown in the measuring window. Three traces are displayed simultaneously:

Trace No. 1: Clear Write; Trace No. 2: Max Hold; Trace No. 3: Min Hold

The midamble selected in *DEMOD SETTINGS / SELECT MIDAMBLE* is used for synchronization.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe EDGE
CONFigure:BURSt:MACCuracy[:IMMediate]
SWEep:COUNt 20
INITiate:IMMediate; *WAI
```

Result queries:

```
FETCh:BURSt:MACCuracy:RMS:AVERage?
FETCh:BURSt:MACCuracy:RMS:MAXimum?
FETCh:BURSt:MACCuracy:PEAK:AVERage?
FETCh:BURSt:MACCuracy:PEAK:MAXimum?
FETCh:BURSt:MACCuracy:OSUPress:AVERage?
FETCh:BURSt:MACCuracy:OSUPress:MAXimum?
FETCh:BURSt:MACCuracy:PERCentile:AVERage?
FETCh:BURSt:MACCuracy:PERCentile:MAXimum?
FETCh:BURSt:MACCuracy:FREQuency:AVERage?
FETCh:BURSt:MACCuracy:FREQuency:MAXimum?
FETCh:BURSt:MACCuracy:IQOFfset:AVERage?
FETCh:BURSt:MACCuracy:IQOFfset:MAXimum?
FETCh:BURSt:MACCuracy:IQIMbalance:AVERage?
FETCh:BURSt:MACCuracy:IQIMbalance:MAXimum?
```

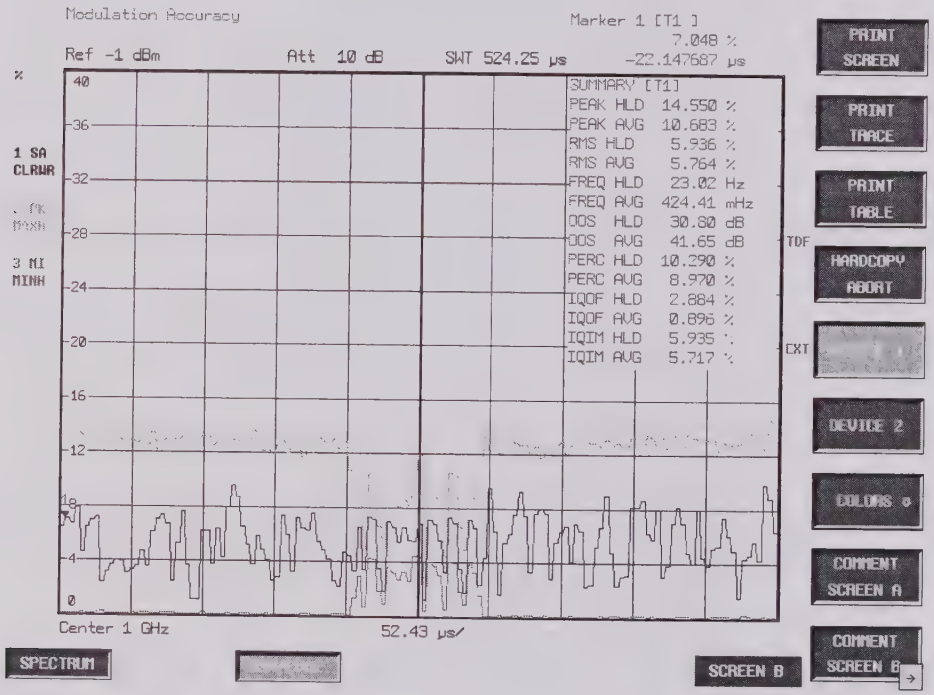


Figure 2-4 Measurement of Modulation Accuracy

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Span = ZERO SPAN
RBW = 300 kHz
Trigger = GSM trigger, i.e. IF Power, assuming IF-Power was set
External trigger, assuming Extern was set

IEC/IEEE bus command `INSTrument[:SELect] SANalyzer`

Test hints

Number of bursts to be measured - *NO OF BURSTS*

The default setting when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).

You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measuring with slow frequency hopping

This mode can be used to measure a mobile with slow frequency hopping, because errors are computed only in the bursts in which the midamble was correctly recognized. When the carrier hops, therefore, the only bursts measured are those whose frequency corresponds to the preset center frequency.

Additional information

MAC measurement requires a time reference to the midamble (TSC 0 to 7 or user midamble). The IF signal is digitized, demodulated and processed (IQ mode) for this measurement.
The given names are examples for EDGE and SINGLE SLOT.

Parameter	Setting	Note
MODE	IQ mode	FS-K5-specific internal mode for demodulation
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	Analog prefilter with 10 MHz 600 kHz filter	
VBW	-	Irrelevant in IQ mode
Symbol rate	270.833 kbit/s	
Oversampling	4/8	
Sampling Length	1600 * oversampling	Number of samples to be recorded = symbols * oversampling
Bits per Symbol	3	Number of bits describing a symbol, constant for EDGE measurements
BURST FIND	ON	Burst find is active
SYNC FIND	ON	Sync find is active
PFE Result Length	142	Number of symbols shown
PFE Sync Mid Offset	0	Offset in symbols of the midamble from the center of the screen.
Teilung der Y-Achse	0 to 40 %, linear, a grid line every 4 % (10 lines)	Trace shows t EVM (Error Vector Magnitude)
TRACE 1	CLEAR WRITE	Trace shows EVM (Error Vector Magnitude)
DETECTOR 1	SAMPLE	
TRACE 2	MAX HOLD	
DETECTOR 2	MAX PEAK	
TRACE 3	MIN HOLD	
DETECTOR 3	MIN PEAK	
LIMIT LINE	None	
LIMIT CHECK	-	

Availability of keys and softkeys

Parameter	Availability	Note
All BW parameters (**BW** menu)	Not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Span parameters (SPAN, FULL/ZERO/LAST SPAN)	Function not available	Measurement is in time domain
Step width of center frequency coupled to resolution bandwidth (AUTO X x RBW)	Function not available	Step width of the center frequency is switched to manual, value 2 kHz
Level reading (REF LEVEL, RANGE LOG/MANUAL/ LINEAR, REF LEVEL POSITION, GRID ABS/REL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Frequency counters (SIGNAL COUNT, COUNTER RESOLUTION)	Function not available	
Reference Fixed-Marker (REFERENCE FIXED menu)	Function not available	
Noise measurement (NOISE MEAS)	Function not available	
Measurement of phase noise (PHASE NOISE menu)	Function not available	
Set reference level to current marker value (REF LEVEL = MKR LEVEL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Quasipeak, autopeak detectors (DETECTOR AUTO PEAK, DETECTOR QPK)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Time domain measurement – determine reference values (SET REFERENCE)	Function not available	Unit in DEG
Time domain measurement – select power measurement (POWER ABS/REL)	Function not available	Unit in DEG
Time domain measurement – set standard deviation (STANDARD DEVIATION)	Function not available	Unit in DEG
Unit (UNIT menu)	Function not available	
Create limit lines (NEW LIMIT LINE)	Function not available	There are no limit lines with the DEG unit

Measurement of phase and frequency error

This measurement is used to determine the accuracy of the phase of each of the 147 useful bits and show the RMS phase error across the useful bits and the maximum phase error in accordance with GSM 05.05 and GSM 11.10 for modulation type GMSK.
The frequency error is computed from the phase of the symbols in accordance with the standards; this frequency error is also displayed.

In addition the IQ imbalance and IQ offset are given in %.

For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

Requirements for the measuring signal

- At least one slot must be active and isolated, because this is the only way of reliably detecting a burst (irrespective of edge steepness)(this applies only if multislot is off, i.e. active slots = sync to slot = 1)
- Sync sequence must be present in the timeslot to be measured

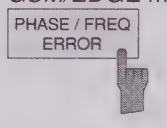
Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	**Operation**
Set frequency	*FREQ* key
Start application	*GSM/EDGE* hotkey
Select GSM trigger Default: IF Power	*TRIGGER EXTERN* or *IF POWER* softkey
Fine-tune level to within approx. 3 dB	AUTO LEVEL&TIME softkey (the trigger offset is set automatically) or *REF LEVEL* softkey → Position burst in mask
Set midamble Default: TSC0	*DEMOD SETTINGS* softkey *SELECT MIDAMBLE* softkey
Start measurement	*PREV* hotkey *PHASE/FREQ ERROR* softkey

Measurement

GSM/EDGE menu



The *PHASE/FREQ ERROR* softkey starts the measurement of the phase and frequency error in accordance with the standard (see Figure 2-5).

The overview of the numeric modulation errors is shown on the screen. The error is calculated over the 147 useful bits.

The amount of the phase error for each of the 147 symbols is calculated. The following values are then calculated and displayed:

PEAK HLD: Peak value of the magnitude of the phase error, calculated over 147 useful bits * *NO OF BURSTS*

PEAK AVG: Average of the peak value of the phase error per burst calculated over the number of bursts defined by *NO OF BURSTS*

RMS HLD: Maximum value of the RMS phase error, calculated over 147 useful bits * *NO OF BURSTS*

RMS AVG: Average of the RMS value of the phase error per burst calculated over the number of bursts defined by *NO OF BURSTS*

FREQ HLD: Peak value of the magnitude of the frequency error, calculated over 147 useful bits * *NO OF BURSTS*

FREQ AVG: Average of the frequency error calculated over the number of bursts defined by *NO OF BURSTS*

IQOF HLD: Peak value of IQ offset, calculated over 147 bits * *NO OF BURSTS*

IQOF AVG: Average of the maximum IQ offset per burst calculated over the number of bursts defined by *NO OF BURSTS*

IQIM HLD: Peak value of IQ imbalance, calculated over 147 bits * *NO OF BURSTS*

IQIM AVG: Average of the maximum IQ imbalance per burst, calculated over the number of bursts defined by *NO OF BURSTS*

These readings can be switched on and off in ***MEAS*** / *TIME DOM POWER*.

The phase error versus time within the 147 useful bits of the normal burst is shown in the measuring window. Three traces are displayed simultaneously:

Trace No. 1: Clear Write

Trace No. 2: Max Hold

Trace No. 3: Min Hold

The midamble selected in *DEMOD SETTINGS / SELECT MIDAMBLE* is used for synchronization.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:BURSt:PFERror[:IMMediate]
SWEep:COUNt 20
INITiate:IMMediate; *WAI
```

Result queries:

```
FETCh:BURSt:PERRor:RMS:AVERage?
FETCh:BURSt:PERRor:RMS:MAXimum?
FETCh:BURSt:PERRor:PEAK:AVERage?
FETCh:BURSt:PERRor:PEAK:MAXimum?
FETCh:BURSt:FERRor:AVERage?
FETCh:BURSt:FERRor:MAXimum?
FETCh:BURSt:IQOFfset:AVERage?
FETCh:BURSt:IQOFfset:MAXimum?
FETCh:BURSt:IQIMbalance:AVERage?
FETCh:BURSt:IQIMbalance:MAXimum?
```

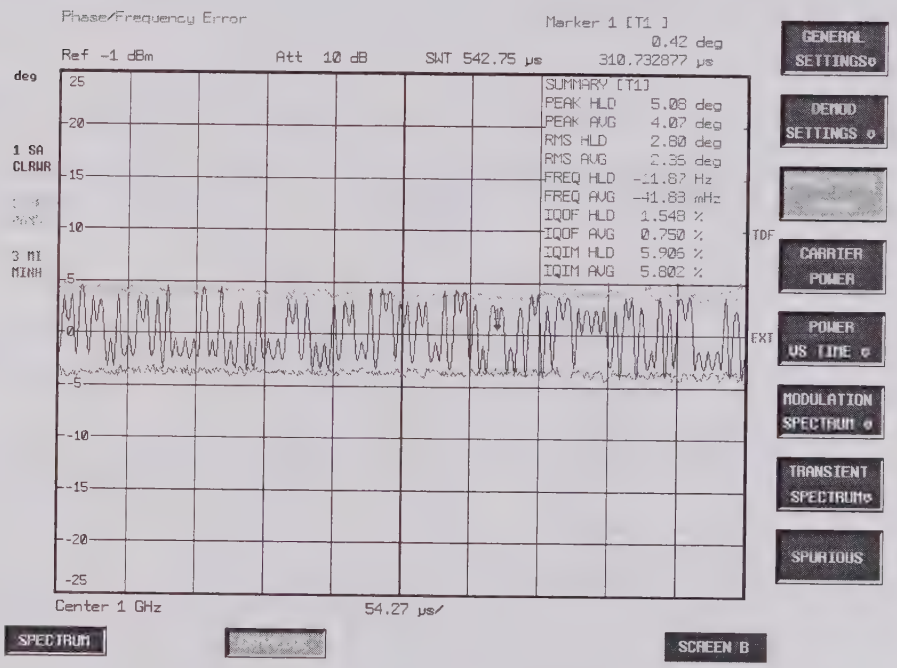


Figure 2-5 Measurement of phase and frequency error

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Span = ZERO SPAN
RBW = 300 kHz
Trigger = GSM trigger, i.e. IF Power, assuming IF-Power was set
External trigger, assuming Extern was set

IEC/IEEE bus command INSTrument[:SELect] SANalyzer

Test hints

Number of bursts to be measured - *NO OF BURSTS*

The default setting when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).

You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measuring with slow frequency hopping

This mode can be used to measure a mobile with slow frequency hopping, because errors are computed only in the bursts in which the midamble was correctly recognized. When the carrier hops, therefore, the only bursts measured are those whose frequency corresponds to the preset center frequency.

Additional information

PFE measurement requires a time reference to the midamble (TSC 0 to 7 or user midamble). The IF signal is digitized, demodulated and processed (IQ mode) for this measurement. The given names are examples for EDGE and SINGLE SLOT.

Parameter	Setting	Note
MODE	IQ mode	FS-K5-specific internal mode for demodulation
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	Analog prefilter with 10 MHz 600 kHz filter	
VBW	-	Irrelevant in IQ mode
Symbol rate	270.833 kbit/s	
Oversampling	4/8	
Sampling Length	1600 * oversampling	Number of samples to be recorded = symbols * oversampling
Bits per Symbol	1	Number of bits describing a symbol, constant for GSM measurements
Receiver Filter	Gauss with BT = 0.3	Constant for GSM measurement
BURST FIND	ON	Burst find is active
SYNC FIND	ON	Sync find is active
PVT Result Length	147	Number of symbols shown
PVT Sync Mid Offset	0	Offset in symbols of the midamble from the center of the screen.
Y axis pitch	-20 to +20 degrees linear, a grid line every 4 degrees	Trace shows phase versus time
TRACE 1	CLEAR WRITE	Trace shows phase versus time
DETECTOR 1	SAMPLE	
TRACE 2	MAX HOLD	
DETECTOR 2	MAX PEAK	
TRACE 3	MIN HOLD	
DETECTOR 3	MIN PEAK	
LIMIT LINE	None	
LIMIT CHECK	-	

Availability of keys and softkeys

Parameter	Availability	Note
All BW parameters (**BW** menu)	Not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Span parameters (SPAN, FULL/ZERO/LAST SPAN)	Function not available	Measurement is in time domain
Step width of center frequency coupled to resolution bandwidth (AUTO X x RBW)	Function not available	Step width of the center frequency is switched to manual, value 2 kHz
Level reading (REF LEVEL, RANGE LOG/MANUAL/ LINEAR, REF LEVEL POSITION, GRID ABS/REL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Frequency counters (SIGNAL COUNT, COUNTER RESOLUTION)	Function not available	
Reference Fixed-Marker (REFERENCE FIXED menu)	Function not available	
Noise measurement (NOISE MEAS)	Function not available	
Measurement of phase noise (PHASE NOISE menu)	Function not available	
Set reference level to current marker value (REF LEVEL = MKR LEVEL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Quasipeak, autopeak detectors (DETECTOR AUTO PEAK, DETECTOR QPK)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Time domain measurement – determine reference values (SET REFERENCE)	Function not available	Unit in DEG
Time domain measurement – select power measurement (POWER ABS/REL)	Function not available	Unit in DEG
Time domain measurement – set standard deviation (STANDARD DEVIATION)	Function not available	Unit in DEG
Unit (UNIT menu)	Function not available	
Create limit lines (NEW LIMIT LINE)	Function not available	There are no limit lines with the DEG unit

Measurement of carrier power

The purpose of measuring carrier power is to determine the output power of the mobile during the useful bits.

This measurement is intended for users whose signal does not have a midamble for time synchronization.
This measurement is performed in the time domain (Zero Span) at the set frequency.
Unlike power display in the PVT measurement mode, the signal is not demodulated for this measurement. This means that measurement in this mode is possible without a midamble.

There are two preconditions for correct measurement, namely correct timing of the trigger offset and correct reference level setting (*AUTO LEVEL&TIME* softkey).

For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

Requirements for the measuring signal

The signal's peak power cannot be more than 1 dB above the reference level.

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSM/EDGE* hotkey
Enter external attenuation Default: 0 dB	*GENERAL SETTINGS* softkey *EXTERNAL ATTEN* softkey
Select GSM trigger	*TRIGGER EXTERN* or *TRIGGER IF POWER* softkey
Fine-tune level to within approx. 1 dB	*AUTO LEVEL&TIME* softkey (the trigger offset is set automatically) or *REF LEVEL* softkey → Position burst in mask
Set trigger offset	*TRIGGER OFFSET* softkey → Position burst time exactly in mask
Start measurement	*PREV* hotkey *CARRIER POWER* softkey

Measurement

GSM/EDGE menu

CARRIER POWER

Press the *CARRIER POWER* softkey to start measurement of carrier power over the 147 useful bits, in accordance with the standard.

The limit lines are displayed.

When power is exactly 3 dB below the reference level, the trace is centered between the upper and lower limit lines.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:BURSt:POWer[:IMMediate]
SWEep:COUNt 20
INITiate:IMMediate; *WAI
```

Result queries:

```
CALCulate:MARKer:FUNCtion:SUMMary:MEAN:RESult?
CALCulate1:LIMit1:NAME 'CPWU_G'
CALCulate1:LIMit2:NAME 'CPWL_G'
CALCulate1:LIMit1:FAIL?
CALCulate1:LIMit2:FAIL?
```

Note: *In remote-control mode, the user must assign the following names to the limit lines before they are used:*

```
CALCulate1:LIMit1:NAME 'CPWU_G' or 'CPWU_E'
CALCulate1:LIMit2:NAME 'CPWL_G' or 'CPWL_E',
```

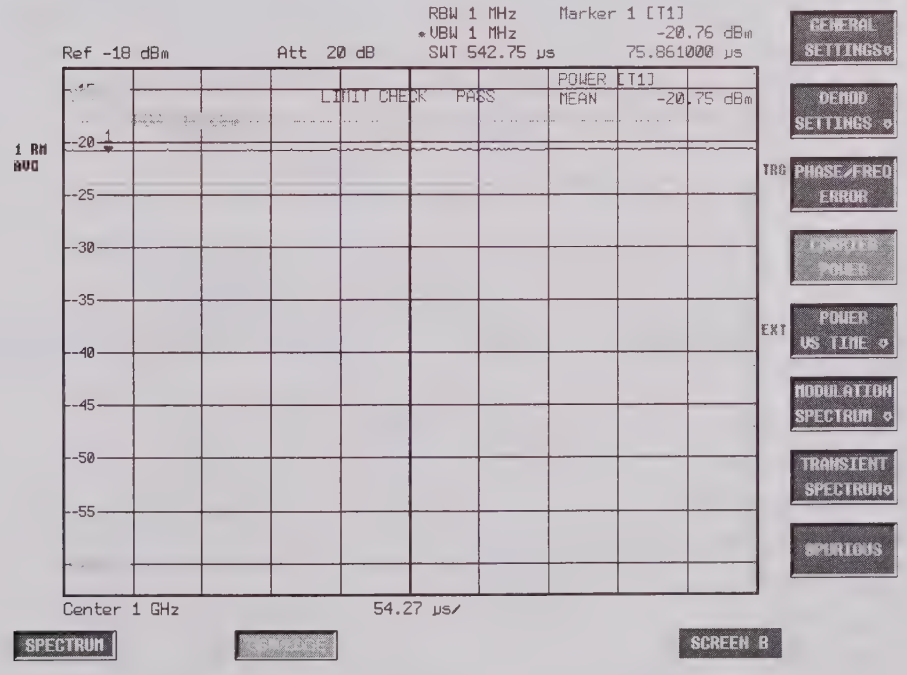


Figure 2-6 Measurement of carrier power

SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. All settings are taken from the GSM/EDGE mode. IF-Power is set for GSM Trigger IF Power, and the external trigger is set for GSM Trigger Extern.

IEC/IEEE bus command

```
INSTrument[:SELect] SANalyzer
```

Test hints

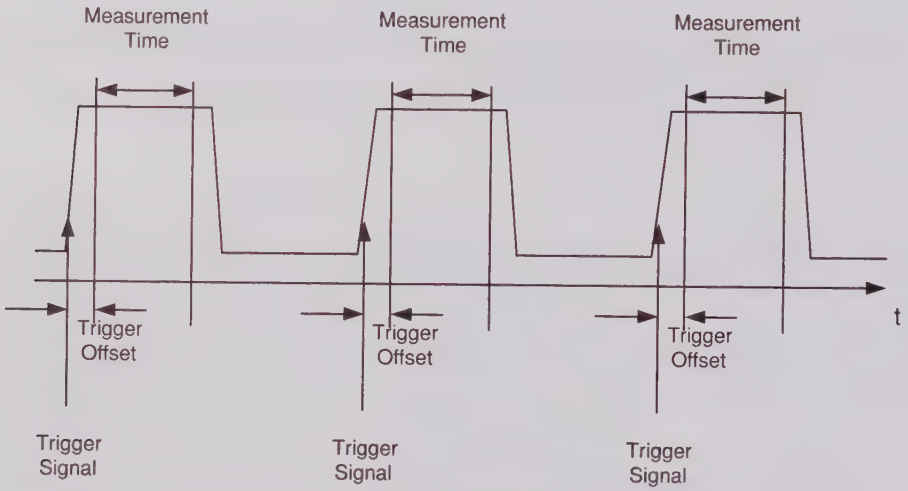
Increase of measurement speed

In remote control, the measurement speed is considerably increased by using the SENSe:MPOWer subsystem. This subsystem provides a fast measurement of the power control levels of a series of consecutive bursts with monotonically decreasing power.

The commands of this subsystem are used to determine the mean burst power or peak burst power for a given number of signal bursts, and for outputting the results in a list. Since all the settings required for a measurement are combined in a single command, the measurement speed is considerably higher than when using individual commands.

For measuring the signal bursts, the GATED SWEEP function is used in the time domain. The gate is controlled either by an external trigger signal or by the video signal. An individual trigger event is required for each burst to be measured. If an external trigger signal is used, the threshold is fixed to TTL level, while with a video signal the threshold can be set as desired.

The following graphics shows the relation between trigger time, trigger offset (for delayed gate opening) and measurement time.



Depending on the settings made, the measurements are performed with the RMS detector for RMS power or the PEAK detector for peak power. For all these measurements, TRACE 1 of the selected system is used.

The setting parameters for this measurement are:

analyzer frequency

resolution bandwidth

measurement time used for a single burst

trigger source

trigger level

trigger offset

type of power measurement (PEAK, MEAN)

number of bursts to be measured

See operating manual of basic unit for details on the SENSe:LIST subsystem.

Transducer factors

The FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Number of bursts to be measured -> *NO OF BURSTS*

The default setting when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measuring with slow frequency hopping

Measurement with slow frequency hopping is possible under the following conditions only:
GSM-Trigger Extern: Trigger only when the burst is transmitted on the defined frequency.
GSM-Trigger IF Power: The IF trigger level is permanently set and cannot be changed.
This means that measurement with slow frequency hopping is very limited and is strictly dependent on the level to be measured.

Measurement of individual power control levels and power classes

The relationships between power, control level and power class specified in the standards are listed in the tables below.

Table 2-2 Power classes

Power Class	Power P-GSM 900 Phase I	E/P/R-GSM900 Phase II	DCS1800 Phase I	DCS1800 Phase II	PCS1900
1	43 dBm	--	30 dBm	30 dBm	30 dBm
2	39 dBm	39 dBm	24 dBm	24 dBm	24 dBm
3	37 dBm	37 dBm	--	36 dBm	33 dBm
4	33 dBm	33 dBm	--	--	--
5	29 dBm	29 dBm	--	--	--

Table 2-3 Power control levels

Power Control Level	Power				
	GSM900 Phase I	GSM900 Phase II/II+	DCS1800 Phase I	DCS1800 Phase II/II+	PCS1900
29	--	--	--	36 dBm	reserved
30	--	--	--	34 dBm	33 dBm
31	--	--	--	32 dBm	32 dBm
0	43 dBm	39 dBm	30 dBm	30 dBm	30 dBm
1	41 dBm	39 dBm	28 dBm	28 dBm	28 dBm
2	39 dBm	39 dBm	26 dBm	26 dBm	26 dBm
3	37 dBm	37 dBm	24 dBm	24 dBm	24 dBm
4	35 dBm	35 dBm	22 dBm	22 dBm	22 dBm
5	33 dBm	33 dBm	20 dBm	20 dBm	20 dBm
6	31 dBm	31 dBm	18 dBm	18 dBm	18 dBm
7	29 dBm	29 dBm	16 dBm	16 dBm	16 dBm
8	27 dBm	27 dBm	14 dBm	14 dBm	14 dBm
9	25 dBm	25 dBm	12 dBm	12 dBm	12 dBm
10	23 dBm	23 dBm	10 dBm	10 dBm	10 dBm
11	21 dBm	21 dBm	8 dBm	8 dBm	8 dBm
12	19 dBm	19 dBm	6 dBm	6 dBm	6 dBm
13	17 dBm	17 dBm	4 dBm	4 dBm	4 dBm
14	15 dBm	15 dBm	--	2 dBm	2 dBm
15	13 dBm	13 dBm	--	0 dBm	0 dBm
16	--	11 dBm	--	0 dBm	reserved
17	--	9 dBm	--	0 dBm	reserved
18	--	7 dBm	--	0 dBm	reserved
19	--	5 dBm	--	0 dBm	reserved
20..28	--	--	--	0 dBm	reserved
20..31	--	5 dBm	--	--	--

Additional information

Parameter	Setting	Note
MODE	Zero Span	
SWEEP mode	CONT under local control SINGLE under remote control	
RBW	1 MHz	
VBW	1 MHz	Coupling off
SWEEP TIME	147 * symbol duration = 147 * 3.6923 µs = 542.75 µs	
REF LEVEL POSITION	90%	
Y axis	LOG_50DB	
TRACE 1	AVERAGE	
DETECTOR 1	RMS	
TRACE 2	BLANK	
DETECTOR 2	-	
TRACE 3	BLANK	
DETECTOR 3	-	
Limit Line	CPWU_G GSM) CPWU_E (EDGE)	X relative to screen left, X values symmetrical with 0, therefore X offset, see below Y relative to reference level
Limit Checks	ON	
Limit Line	CPWU_G GSM) CPWU_E (EDGE)	-"-
Limit Checks	ON	
Limit X OFFSET	SWT/2 = 270µs	So that limit line symmetrical with 0 is in center of screen
Limit Y OFFSET	- 3dB	
Time Domain Power measurement	ON for Trace 1	

Availability of keys and softkeys

Parameter	Availability	Note
SWEEP TIME	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Span parameters (SPAN, FULL SPAN, ZERO SPAN, LAST SPAN)	Function not available	Measurement is in time domain
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Filter (FILTER TYPE)	Function not available	

Measurement of carrier power versus time

Measuring carrier power versus time provides a means of checking the time characteristic of a burst's power and the time reference between the burst edges and the midamble.
The power of the burst, moreover, is measured with synchronization to the midamble (as stipulated in the standard) and displayed.

To this end freely definable limit lines are shown, and the time characteristic of carrier power is measured against them in the ZERO SPAN mode.
Reference measurement is available as a means of obtaining a correct level setting for the limit values.

Synchronization with the midamble of the burst is active in this measurement mode (unlike the Carrier Power mode) (13/14 bit transition of the midamble). This ensures a correct time reference for the burst at all times.
For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

When external trigger is used the time between external trigger and first sample of the first bit of midamble will be calculated and displayed.

Requirements for the measuring signal

- At least one slot must be active and isolated, because this is the only way of reliably detecting a burst (irrespective of edge steepness)
- Sync sequence must be present in the timeslot to which synchronization is to be made

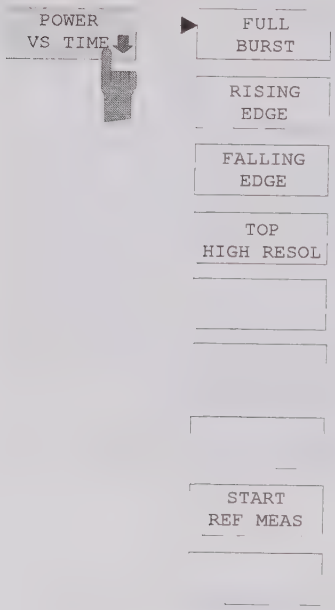
Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSM/DEGE* hotkey
Select GSM trigger	*GENERAL SETTINGS* softkey TRIGGER EXTERN or TRIGGER IF POWER softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey or *REF LEVEL* softkey → Position burst in horizontal limit-value lines
Enter external attenuation Default: 0 dB	*EXTERNAL ATTEN* softkey
Set midamble Default: TSC0	DEMOD SETTINGS softkey SELECT MIDAMBLE softkey
Start measurement	*PREV* hotkey *POWER VS TIME* softkey
Start reference measurement	*START REF MEAS* softkey

Measurement

GSM/EDGE menu



Press the *POWER VS TIME* softkey to start measurement of carrier power versus time and open a submenu for configuring the display. The power of the burst is also measured as centered relative to the midamble and displayed.
When theexternal trigger is used the time between external trigger and first sample of the first bit of midamble will be calculated and displayed (not for rising / falling edge), see figure 1-4 in chapter 1, section "Trigger and time references".

In this time measurement two values are displayed:

TRGS HLD — MaxHold value of the measured times between trigger and midamble start
Example1: 20, -10, 30 => Max 30.
Example 2: 20, -10, -30 => Max –30.

TRGS AVG — Average value of the measured times between trigger and midamble start

The current value (without averaging / max hold) is displayed if Sweep Count (= No.Of Bursts) is set to 1.

Three curves are displayed:

Max Peak, Min Peak and Average (number of bursts > 1, if number of bursts = 1 only one curve is shown).

The limit values are checked against the Average Trace (default)

The settings for checking the max trace against the upper limit line and the min trace against the lower limit line are performed in the LINES menu.

4 display modes are possible:

- Display of entire burst (*FULL BURST*)
- Display of useful part of burst at high resolution (*TOP HIGH RESOL*)
- Display of rising edge of burst (*RISING EDGE*)
- Display of falling edge of burst (*FALLING EDGE*)

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect FULL
SWEep:COUNt 20
READ:BURSt:PTEMplate:REFerence[:IMMediate]?
INITiate:IMMediate; *WAI
```

Result queries:

```
FETCh:BURSt:PTEMplate:TRGS:AVERage?
FETCh:BURSt:PTEMplate:TRGS:MAXimum?
CALCulate1:LIMit1:NAME 'PVTU_G'
CALCulate1:LIMit2:NAME 'PVTL_G'
CALCulate1:LIMit1:FAIL?
CALCulate1:LIMit2:FAIL?
```

Note:
In remote-control mode, the user must assign the following names to the limit lines before they are used.

You have a free choice of display mode for the measured-value diagram.
CALCulate1:LIMit1:NAME 'PVTU_G' or 'PVTU_E' and
CALCulate1:LIMit2:NAME 'PVTL_G' or 'PVTL_E',
respectively

In the case of multislot measurements, a digit is appended to the letter to indicate the number of active slots.

Example: EDGE (single slot): PVTU_E
EDGE (multi slot, 4 active): PVTU_E4
The name of each activated limit line is displayed next to the line. The upper and the lower limit line for the 8 active slots are each composed of two limit lines (A and B). An A or B is added to the limit line name in this case.

FULL BURST

The *FULL BURST* softkey selects a display mode in which the entire burst (single slot mode) or the set number of active slots (multi slot mode) can be viewed on the monitor.
The limit check is performed with a resolution of 4 or 8 samples per symbol, not with the display resolution, which may be considerably lower. All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.
The corresponding limit lines are shown on the monitor.

IEC/IEEE bus command CONFigure:BURSt:PTEMplate:SELect FULL

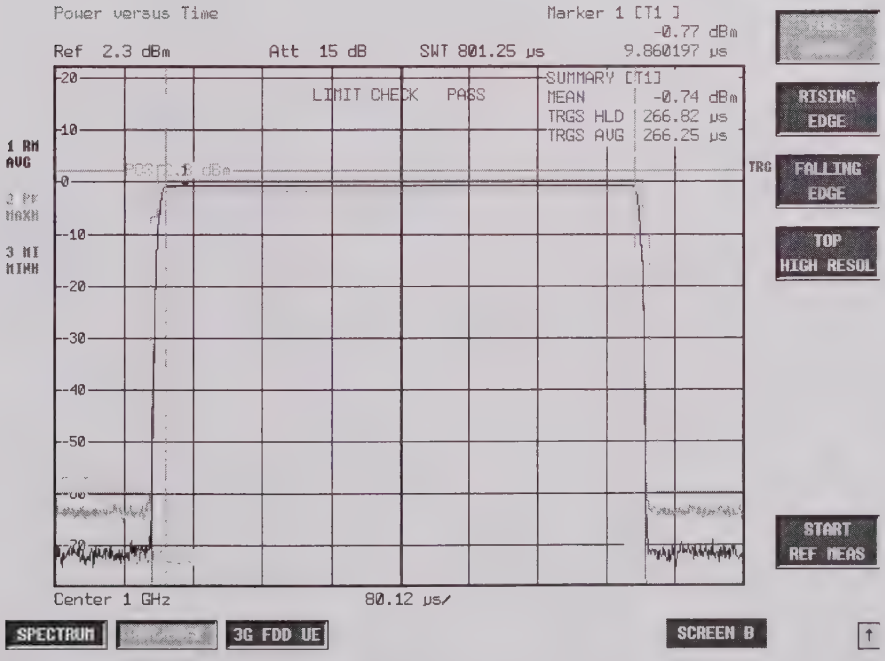


Figure 2-7 PVT single slot measurement – FULL BURST

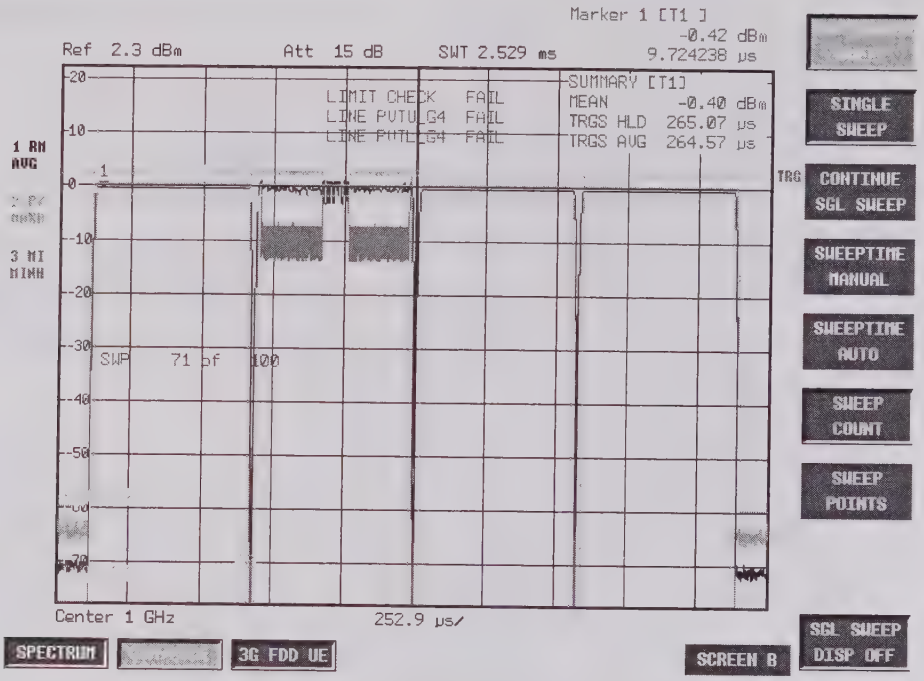


Figure 2-8 PVT multi slot measurement – FULL BURST, 4 slots active

RISING EDGE

Press the *RISING EDGE* softkey to select a display mode in which the rising edge of the burst can be viewed on the monitor.

For multi slot signals, the rising edge of the first active burst is indicated.

All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.

The corresponding limit lines are shown on the monitor. The 30 symbols are checked against the lmit lines with a resolution of 4 or 8 points per symbol.

IEC/IEEE bus command `CONFigure:BURSt:PTEMplate:SELect RISing`

Figure 2-9 PVT measurement – RISING EDGE

FALLING EDGE

Press the *FALLING EDGE* softkey to select a display mode in which the falling edge of the burst can be viewed on the monitor.

For multi slot signals, the falling edge of the last active burst is indicated.

All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.

The corresponding limit lines are shown on the monitor.The 30 symbols are checked against the lmit lines with a resolution of 4 or 8 points per symbol.

IEC/IEEE bus command `CONFigure:BURSt:PTEMplate:SELect FALLing`

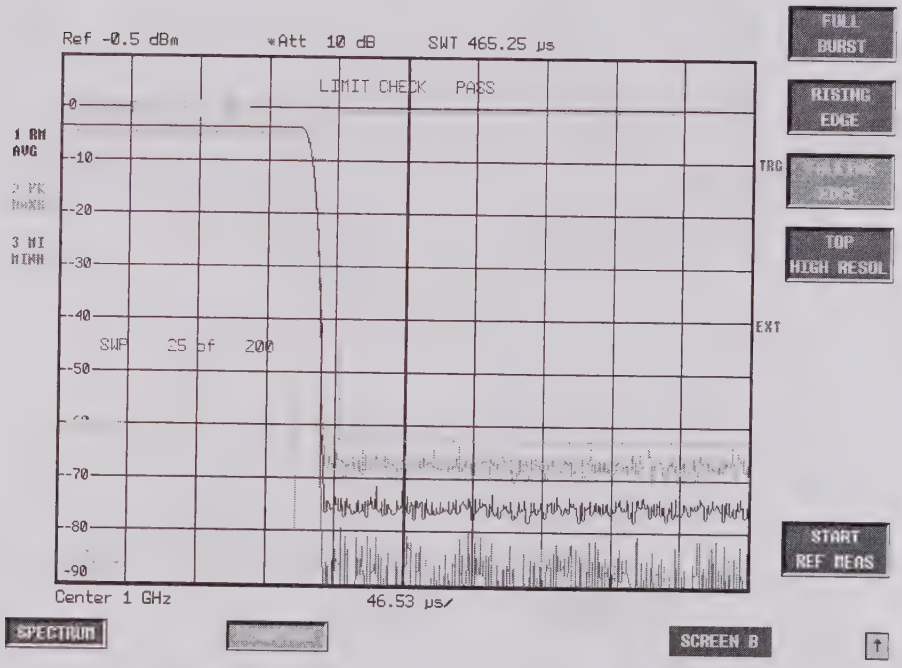


Figure 2-10 PVT measurement – FALLING EDGE

TOP
HIGH RESOL

Press the *TOP HIGH RESOL* softkey to select a display mode in which the useful part of the entire burst/bursts can be viewed on the monitor with a level resolution of 1 dB/Div.

The limit check is performed wit a resolution of 4 samples per symbol, not with the display resolution, which may be considerably lower.

All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.

The corresponding limit lines are shown on the display.

IEC/IEEE bus command `CONFigure:BURSt:PTEMplate:SELect TOP`

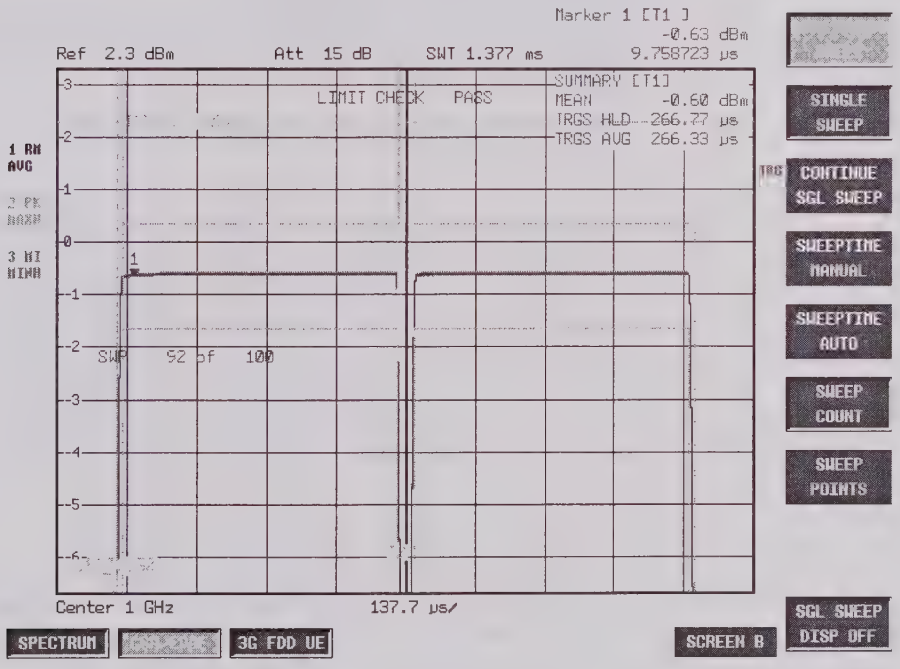
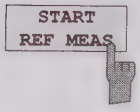


Figure 2-11 PVT measurement – TOP HIGH RESOLUTION



Press the *START REF MEAS* softkey to start reference measurement and determine the reference power for the relative measured values as well as obtain the correct level setting for the limit lines of the measurement.

Depending on the level obtained in this way, a brief message appears, drawing your attention to the optimum reference level. This permits optimum modulation of the device.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect FULL
READ:BURSt:PTEMplate:REFerence[:IMMediate]?
```

Details of reference measurement:

The purpose of reference measurement is to obtain the reference for the applicable limit values. Averaging is always over at least 20 bursts, irrespective of the number of bursts (*NO. OF BURSTS = SWEEP COUNT*) selected for measurement as such.

If reference measurement is cancelled, the existing level of the limit lines remains unaffected.

If reference measurement is successful, the measured level is displayed and the limit lines centered relative to it (i.e. the Y offset parameter of the limit lines is recalculated).
Once determined in this way, the reference level is retained either until a preset is performed (default reference level = -20 dBm), or until a new reference measurement is started.
This means that after performing reference measurement once, the user can perform other GSM measurements for the same signal.
The reference level, once measured, is stored in memory when the GSM application is closed, which means that it remains available for the next session.

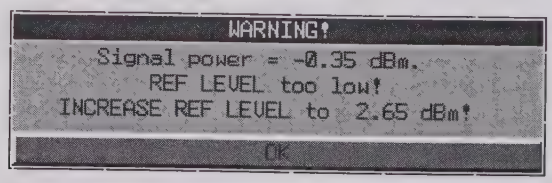
Warnings issued during reference measurement

The expected power of the DUT is 3 dB below the reference level. If GSM measurements were performed right at the reference level, there would be a danger of overloading the analyzer above the reference level.

If the reference level is too low, i.e.

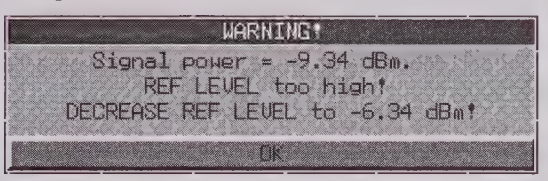
Signal level of DUT – (reference level + reference-level offset) > - 5 dB

the following message is issued:



The carrier overload bit in IEC/IEEE bus status management is set.

If the reference level is too high, i.e.
Signal level of DUT – (reference level + reference-level offset) > -11 dB
the following message is issued:



The no carrier bit in IEC/IEEE bus status management is set.

If the reference level is in range, i.e.
-11 dB < signal level of DUT – (reference level + reference-level offset) < - 5 dB
the following message is issued:

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically as described below; all other settings are taken from the GSM/EDGE mode:

Span = ZERO SPAN
RBW = 300 kHz
Trigger = GSM trigger

IEC/IEEE bus command `INSTrument[:SELect] SANalyzer`

Test hints

Power measurement with reference to midamble

The PVT mode can be used for high-precision measurement of burst power referenced to the 13/14 bit transition of the midamble.

The relationships between power, control level and power class specified in the standards are listed in the tables below.

Table 2-4 Power classes

Power Class	Power				
	P-GSM 900 Phase I	E/P/R-GSM900 Phase II	DCS1800 Phase I	DCS1800 Phase II	PCS1900
1	43 dBm	--	30 dBm	30 dBm	30 dBm
2	39 dBm	39 dBm	24 dBm	24 dBm	24 dBm
3	37 dBm	37 dBm	--	36 dBm	33 dBm
4	33 dBm	33 dBm	--	--	--
5	29 dBm	29 dBm	--	--	--

Table 2-5 Power control level

Power Control Level	Power				
	GSM900 Phase I	GSM900 Phase II/II+	DCS1800 Phase I	DCS1800 Phase II/II+	PCS1900
29	--	--	--	36 dBm	reserved
30	--	--	--	34 dBm	33 dBm
31	--	--	--	32 dBm	32 dBm
0	43 dBm	39 dBm	30 dBm	30 dBm	30 dBm
1	41 dBm	39 dBm	28 dBm	28 dBm	28 dBm
2	39 dBm	39 dBm	26 dBm	26 dBm	26 dBm
3	37 dBm	37 dBm	24 dBm	24 dBm	24 dBm
4	35 dBm	35 dBm	22 dBm	22 dBm	22 dBm
5	33 dBm	33 dBm	20 dBm	20 dBm	20 dBm
6	31 dBm	31 dBm	18 dBm	18 dBm	18 dBm
7	29 dBm	29 dBm	16 dBm	16 dBm	16 dBm
8	27 dBm	27 dBm	14 dBm	14 dBm	14 dBm
9	25 dBm	25 dBm	12 dBm	12 dBm	12 dBm
10	23 dBm	23 dBm	10 dBm	10 dBm	10 dBm
11	21 dBm	21 dBm	8 dBm	8 dBm	8 dBm
12	19 dBm	19 dBm	6 dBm	6 dBm	6 dBm
13	17 dBm	17 dBm	4 dBm	4 dBm	4 dBm
14	15 dBm	15 dBm	--	2 dBm	2 dBm
15	13 dBm	13 dBm	--	0 dBm	0 dBm
16	--	11 dBm	--	0 dBm	reserved
17	--	9 dBm	--	0 dBm	reserved
18	--	7 dBm	--	0 dBm	reserved
19	--	5 dBm	--	0 dBm	reserved
20..28	--	--	--	0 dBm	reserved
20..31	--	5 dBm	--	--	--

Measuring with slow frequency hopping

Analysis of the burst's time characteristic and the power readings include only the bursts that
a) can be demodulated correctly and
b) have the midamble set under DEMOD SETTINGS.
If these conditions are not fulfilled the "SYNC NOT FOUND" message is issued and evaluation of the measured values stops. Measurement automatically resumes on arrival of a burst with the defined midamble.

Demodulation is possible only when the DUT's carrier is on the defined frequency.
This precaution is adopted to avoid falsification of the measured values by bursts outside ARFCN and bursts with the wrong midamble.

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see spectrum analyzer manual). You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measurement with maximum dynamic range

Once you have used *FULL BURST* or *TOP HIGH RESOLUTION* to ascertain that the limit lines cannot be exceeded, you can employ the method described below to extend the analyzer's usable dynamic range by a few dB:

- Move the reference level to max. 2 dB below the actual power of the signal (see power reading on the screen in Full Burst mode),
- Set RF ATTEN as low as possible
- Reselect measurement (*FULL BURST, RISING EDGE, FALLING EDGE)*
  This slightly overloads the device, without falsifying the measurement. The mask is now automatically centered relative to the actual level.

Note: *If the power of the mobile is less than –20 dBm it is essential to remove external attenuation in order to achieve the maximum possible dynamic range.*

The increase in S/N ratio in dB is roughly equal to the reduction in reference level and the removed attenuation (RF ATTEN = 10 dB).

Increasing the measurement speed during remote control

The following example shows a fast PVT measurement without using a pre-measurement.
The signal level is estimated during the measurement.
With this level the Limit Line reference level is adjusted after all measurements but before limit check.

```
//-------------------------------------------------------------------------------------------------------------------------------
-----------------------------------------
//PVT_without_refmeas_cnt0.cmd
// no PVT reference measurement because Limit Line Y Offset calculated alone
// the reference level is correctly set due to the power control level
// Complete time with display off: 1.5 s
// Select PVT MEAS -> switch to single sweep automatically

//Assumes following settings before script:
//INST:SEL MGSM
//CONFIGURE:BURST:PTEMPLATE
//SENSE1:SWEEP:COUNT 0

// Mid channel PL0
FREQ:CENTER             1.0GHZ
DISP:WIND:TRAC:Y:SCAL:RLEVEL 3 DBM
:INPUT1:ATTENUATION 15

//!no ref meas! :READ:BURST:PTEMPLATE:REFERENCE?
INIT;*WAI

//read out value of mean power
:CALCULATE1:MARKER1:FUNCTION:SUMMARY:MEAN:RESULT?
//the limit values are relative to the reference level
//calculate the y-limit offset so that the lines correspond
//with the current measured mean power: YOffVal=MeanResult-RefLevel
//Use the calculated new YOffVal
//:CALCULATE1:LIMIT:UPPER:OFFSET YOffVal
:CALCULATE1:LIMIT:UPPER:OFFSET -0.5     //Example
:CALCULATE1:LIMIT1:FAIL?
:CALCULATE1:LIMIT2:FAIL?

// Mid channel PL8
// no FREQ:CENTER   because same channel
DISP:WIND:TRAC:Y:SCAL:RLEVEL 4 DBM
:INPUT1:ATTENUATION 20
INIT;*WAI
//read out value of mean power
:CALCULATE1:MARKER1:FUNCTION:SUMMARY:MEAN:RESULT?
//the limit values are relative to the reference level
//calculate the y-limit offset so that the lines correspond
//with the current measured mean power: YOffVal=MeanResult-RefLevel
//Use the calculated new YOffVal
//:CALCULATE1:LIMIT:UPPER:OFFSET YOffVal
:CALCULATE1:LIMIT:UPPER:OFFSET -0.3     //Example
:CALCULATE1:LIMIT1:FAIL?
:CALCULATE1:LIMIT2:FAIL?

// Low channel PL15
FREQ:CENTER             0.999999GHZ
DISP:WIND:TRAC:Y:SCAL:RLEVEL 5 DBM
:INPUT1:ATTENUATION 25
```

```
INIT;*WAI;
//read out value of mean power
:CALCULATE1:MARKER1:FUNCTION:SUMMARY:MEAN:RESULT?
//the limit values are relative to the reference level
//calculate the y-limit offset so that the lines correspond
//with the current measured mean power: YOffVal=MeanResult-RefLevel
//Use the calculated new YOffVal
//:CALCULATE1:LIMIT:UPPER:OFFSET YOffVal
:CALCULATE1:LIMIT:UPPER:OFFSET -0.6     //Example
:CALCULATE1:LIMIT1:FAIL?
:CALCULATE1:LIMIT2:FAIL?
```

Additional information

PVT measurement requires a time reference to the midamble (TSC 0 to 7). The IF signal is digitized, demodulated and processed (IQ mode) for this measurement.
The times and names displayed for the limit lines refer to GSM and single-slot measurements.

Parameter	Setting	Note
MODE	IQ mode	FS-K5-specific internal mode for demodulation
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	analog prefilter with 10 MHz 600 kHz filter	
VBW	-	Irrelevant in IQ mode
REF LEVEL POSITION	90 %	Level overshoots visible at 90%
Symbol rate	270.833 kbit/s	
Oversampling	4/8	
Sampling Length	1600 * oversampling	Number of samples = symbols * oversampling
Bits per Symbol	1	Number of bits describing a symbol, constant for GSM measurements
Receiver Filter	Gauss with BT = 0.3	Constant for GSM measurement
BURST FIND	ON	Burst find is active
BURST FIND	ON	Sync find is active
PVT Result Length FULL BURST & TOP HIGH RES RISING EDGE FALLING EDGE	 217 126 126	Number of symbols shown
PVT Sync Mid Offset FULL BURST & TOP HIGH RES RISING EDGE FALLING EDGE	 0 93 –93	Offset in symbols of the midamble from the center of the screen. Positive means that the midamble is offset to the right of center. Explanation: To put rising on symbol 82: 82 – 0.5 Result Length + symbols between edge and midamble = 82 – 0.5*126 + 0.5*148 To put falling on symbol 44: 0.5*126-44-0.5*148=-55
Y axis pitch FULL & RISING & FALLING TOP HIGH RESOL	 LOG_100DB LOG_10DB	Trace shows level versus time
TRACE 1	AVERAGE	
DETECTOR 1	RMS	
TRACE 2	MAX HOLD	
DETECTOR 2	MAX PEAK	
TRACE 3	MIN HOLD	
DETECTOR 3	MIN PEAK	
Limit Line	PVTU_G	
Limit Checks	ON	
Limit Line	PVTL_G	
Limit Checks	ON	
Limit X-Offset FULL BURST & TOP HIGH RES RISING EDGE FALLING EDGE	 400.625µs 576.00µs -110.75µs	Limit line is centered on midamble
Limit Y-Offset	Signal power measured in reference measurement – (Ref Level + Ref Level Offset)	Reference measurement result corrects the limit lines

Availability of keys and softkeys

Availability		
All BW parameters (**BW** menu)	Not available	Parameters not available in IQ mode
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, If POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Span parameters (SPAN, FULL SPAN, ZERO SPAN, LAST SPAN)	Function not available	Measurement is in time domain
Step width of center frequency coupled to resolution bandwidth (AUTO X x RBW)	Function not available	Step width of the center frequency is switched to manual, value 2 kHz
Frequency counters (SIGNAL COUNT, COUNTER RESOLUTION)	Function not available	
Reference Fixed-Marker (REFERENCE FIXED menu)	Function not available	
Quasipeak, autopeak detectors (DETECTOR AUTO PEAK, DETECTOR QPK)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Switch to linear scaling (RANGE LINEAR)	Function not available	Logarithmic scaling for PVT
Noise measurement (NOISE MEAS)	Function not available	
Measurement of phase noise (PHASE NOISE menu)	Function not available	
Trigger offset (TRIGGER OFFSET)	Function not available	Although it can be set in the GENERAL SETTINGS menu, this parameter has on effect in this mode of measurement.

Measurement of spectrum due to modulation

In order not to influence the transmission quality of the adjacent channels, it is important to ensure that the power of the GSM transmit signal in the adjacent channels does not exceed the limits set down in the GSM standards. On account of the TDMA structure of the GSM signal, a distinction has to be drawn between the spectrum due to modulation and the spectrum due to switching of the TDMA bursts. Measurement of the spectrum due to modulation determines power outside the transmission channel due to the GMSK modulation procedure used and the noise.
In accordance with the GSM standard, the spectrum due to modulation is measured in the range between 50% and 90% of the active TDMA bursts. This ensures that the influence of the burst edges is excluded.
Defined limit values apply; these values depend on the transmit power of the transmitter and the offset from the nominal channel frequency. These limit values (with the exception of the absolute lower limits) are relative to the power measured at 30 kHz RBW. This power has to be ascertained by reference measurement. Depending on the result of this reference measurement, the spectrum analyzer selects the correct reference value for the user-selected limit values for the spectrum due to modulation.
The FS-K5 offers two different ways of measuring the spectrum due to modulation:

- General measurement across the frequency range (the *FREQUENCY SWEEP* softkey) with display of the spectrum, and
- Measurement of the spectrum due to modulation in the time domain with discrete frequencies (±100, ±200, ±250 kHz, ± n x 200 kHz ($2 \leq n \leq 38$) from the carrier frequency) and output of the measured values in a list (the *START LIST* softkey).

The time reference for measurement is provided by the set trigger offset. Starting at this time, the spectrum between 50% and 90% of the active burst is measured (gating). It is, therefore, important to ensure that trigger timing is set correctly in the *GENERAL SETTINGS* menu, as otherwise the spectrum due to modulation cannot be measured correctly.
A correct reference level is important for optimum dynamic range of the spectrum analyzer.

Requirements for the measuring signal

At least one GSM timeslot must be switched on for the signal to be measured.

Multislot Measurements

If several slots are active (multislot measurement), two methods are available:
1. Measurement of one slot selectable from the active slots.
2. Measurement of several active slots and output of combined result.
   The second method yields a considerable increase in the MOD measurement speed.

Method 1

Purpose:

This method is used for measuring the modulation spectrum of a specific slot if there are several active slots.

Precondition:

An external frame trigger must be available.

Settings:

➢ Enter the number of active slots (ACTIVE SLOTS softkey) and the slot to be measured (*SYNC TO SLOT* softkey) in the *MULTISLOT* submenu.
SYNC TO SLOT informs the GSM measurement software of the number of the slot to be measured. The GSM measurement software sets the correct trigger offset (and thus the correct gate times) for the selected slot (based on the slot timing defined by the ETSI standard).

➢ If the slots are separated by variable offsets, it is advisable to run the AUTO LEVEL&TIME function before starting the MOD measurement. Prior to starting this function, the midamble of the slot to be measured must be correctly set under *DEMOD SETTINGS / SELECT MIDAMBLE*. Thus, the trigger offset setting of the slot to be measured is referred to its midamble.

Method 2

Purpose:

This method is used to measure the modulation spectrum of each slot and average the results over the number of slots (= NO. OF BURSTS) if there are several active slots.
The measurement speed increases with the number of active slots.

Example:

Measurement 1

NO. OF BURSTS = 200
Frame pattern: 10000000 (1: slot active, 0: slot inactive)
Duration of measurement (theoretical):
≥ **20 sec** (number of bursts (200) x freq meas points (22) x frame period (4.6 ms))

Measurement 2:

NO. OF BURSTS = 200
Frame pattern: 10101010 (1: slot active, 0: slot inactive)
Duration of measurement (theoretical):
≥ **5 sec** (number of bursts (200) x freq meas points (22) x frame period (4.6 ms) / **4**)

Precondition:

The RF power trigger (FSP) or the IF power trigger (FSU) or an external slot trigger (responding to active slots only) must be set.

Settings:

Set the number of active slots to 1 by means of the *MULTISLOT* softkey.

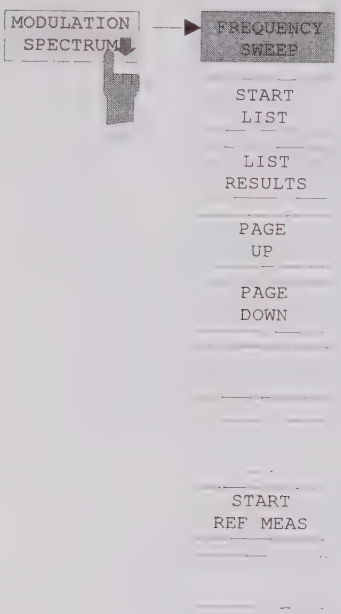
Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSMEDGE* hotkey
Enter external attenuation Default = 0 dB	*GENERAL SETTINGS* softkey *EXTERNAL ATTEN* softkey
Select trigger	*TRIGGER EXTERN* or *TRIGGER IF POWER* softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey (the trigger offset is set automatically) or *REF LEVEL* softkey → Position burst in mask
Set trigger offset	*TRIGGER OFFSET* softkey → Position burst time exactly in mask
Start reference measurement	*PREV* hotkey *START REF MEAS* softkey
Start measurement	*START LIST* softkey

Measurement

GSM/EDGE menu



The *MODULATION SPECTRUM* softkey calls the submenu for measuring the spectrum due to modulation. In the default setting, the spectrum analyzer measures the spectrum due to modulation in the frequency domain (*FREQUENCY SWEEP*).

Alternatively and in accordance with the standard, *START LIST* can be used to measure in the time domain.
In this mode the spectrum analyzer measures the spectrum due to modulation in the time domain at the frequency offsets required by the GSM standard (in the spectral range from max. ARFCN +/- 7.6 MHz) and presents the results in list form.
You can use *LIST RESULTS* at any time to view the last measurement in the time domain. If the list is too long to fit onto one screen page, you can use *PAGE UP* and *PAGE DOWN* to scroll through the list.

When the *MODULATION SPECTRUM* menu is opened for the first time, the parameters are set in accordance with the GSM standards (see Additional information for other settings):

Span	3.6 MHz
Resolution bandwidth	30 kHz
Video bandwidth	30 kHz
Detector/trace	Average, log average
Sweep time	75 ms
Sweep count	0 (floating trace averaging)
Sweep	gated (50 to 90 % of the burst)

The settings correspond to those made when the *FREQUENCY SWEEP* softkey is pressed. The parameter settings can be changed. They are not reset until you exit MOD measurement (by starting another measurement or exiting the GSM/EDGE) or press the *FREQUENCY SWEEP* softkey.

When you start list measurement (*START LIST*) or reference measurement (*START REF MEAS*), the parameter settings used are those currently valid.

The applicable limit values are referred to the signal's absolute level measured in a user-definable bandwidth (preset is 30 kHz). This reference level is determined by reference measurement performed with *START REF MEAS*.

The *FREQUENCY SWEEP* softkey starts continuous measurement of the spectrum due to modulation in the "Continuous Sweep" mode.
All the parameters used in MOD measurement are reset to their default values (see above, the *MODULATION SPECTRUM* softkey).
The spectrum analyzer displays the spectrum and a limit line with limits corresponding to the level (determined beforehand in reference measurement) of the DUT.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt 20
READ:SPECtrum:MODulation:REFerence[:IMMediate]?
INITiate:IMMediate; *WAI
```

Result queries:

```
CALCulate1:LIMit1:NAME 'MODU_G'
CALCulate1:LIMit1:FAIL?
```

Note: *In remote-control mode, the user must assign the following name to the limit line before it is used:*

```
CALCulate1:LIMit1:NAME 'MODU_G' or 'MODU_E'
```

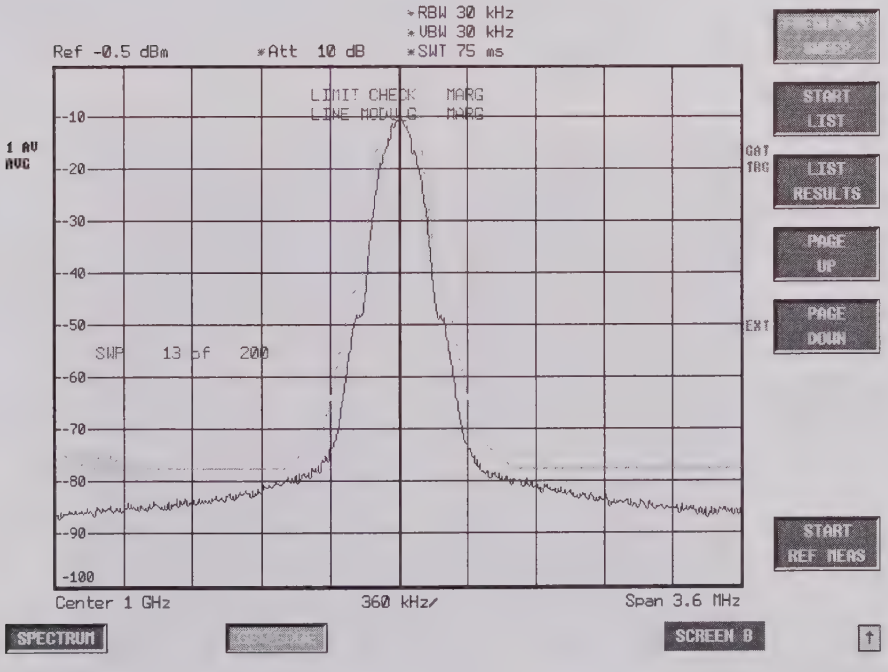


Figure 2-12 Spectrum due to modulation in frequency domain

Press the *START LIST* softkey to start measurement of the spectrum due to modulation in the time domain in the section of the TDMA burst defined in the standards (50% to 90% of the useful part).

The analyzer measures at the following offsets from the channel frequency:
± 100 kHz, ± 200 kHz, ±250 kHz, ±400 kHz, ±n*200 kHz
(n whole number and n ≤ 38; limit frequency included, the channel frequency itself is excluded).
The number n of discrete frequencies is defined by the span , which is user-selectable in the range from 200 kHz to 15.2 MHz. This value is always determined from the SPAN value used also for the *FREQUENCY SWEEP* measurement:
The following conventions apply:

SPAN = 0	spectr. measuring range = ± 1.8 MHz
0 < SPAN ≤ 200 kHz	spectr. measuring range = ± 100 kHz
200 kHz < SPAN ≤ 15.2 kHz	spectr. measuring range = SPAN
SPAN = 15.2 MHz	spectr. measuring range ± 7.6 MHz

You can choose the resolution bandwidth, but note that this bandwidth is reset to 30 kHz when you press the *FREQUENCY SWEEP* softkey.

In the time domain, the measurement is performed with the AVERAGE detector. Averaging is done during the active part of the GSM or EDGE burst (50 to 90 %) over the selected number of bursts. The measurement time depends on the number of averages required (SWEEP COUNT = number of TDMA burts to be averaged.

While measurement is in progress, the measured values at the various frequency offsets are displayed briefly in the measurement diagram. The curve reflects progress of the measurement.
The power measured beforehand with a freely selectable resolution bandwidth is used as the reference power for the relative measured values and for the position of the limit lines. Reference measurement therefore has to be performed beforehand with the appropriate parameter settings in order for measurement to be correct.

When the measuring sequence is completed, the results are displayed in list form.

The values marked with an x violate the margin.

The values marked with an asterisk (*) violate the limit value.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt 20
READ:SPECtrum:MODulation:REFerence[:IMMediate]?
READ:SPECtrum:MODulation[:ALL]?
```

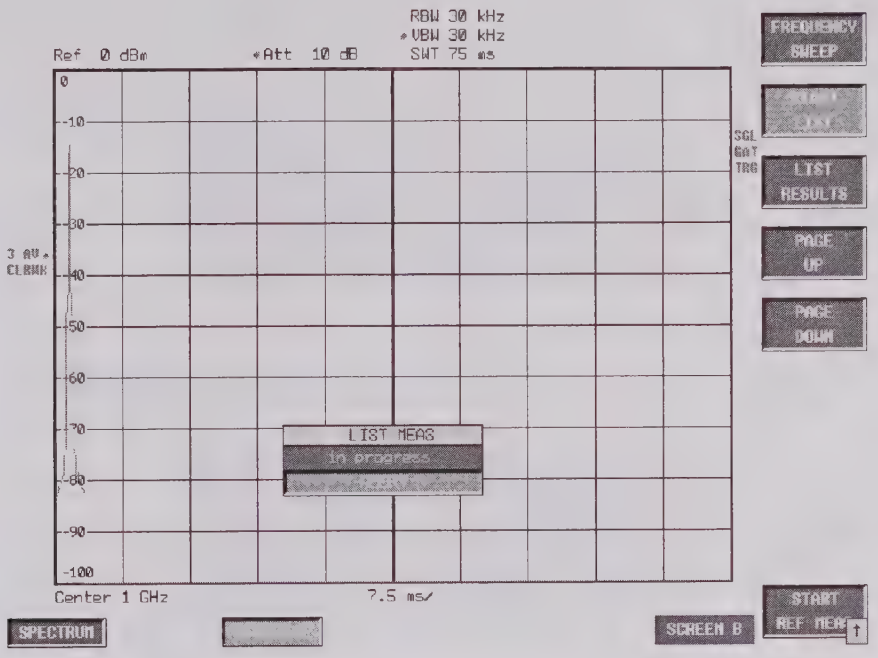


Figure 2-13 Time domain measurement in progress

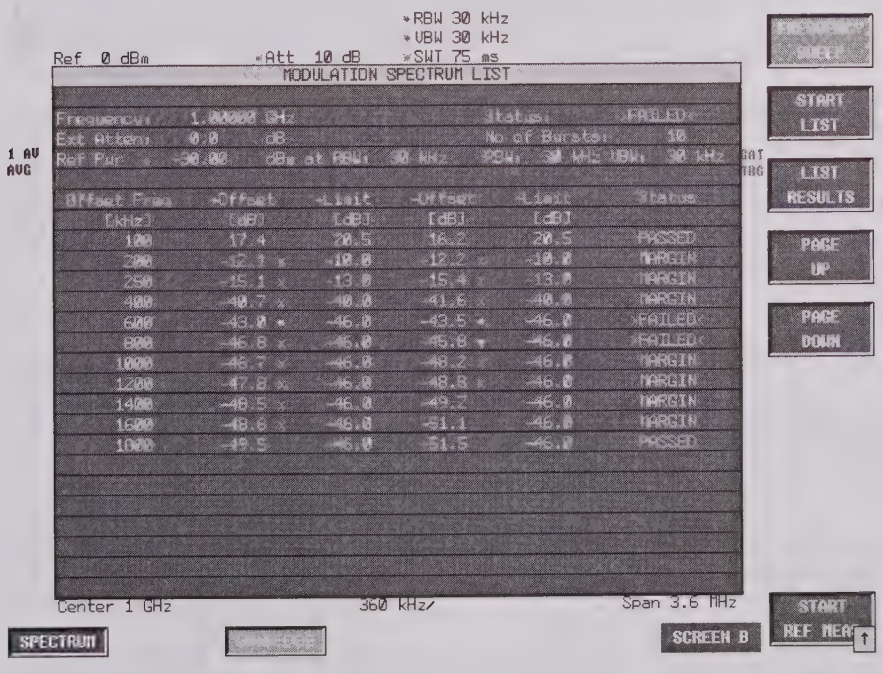

*RBW 30 kHz
*VBW 30 kHz
Ref 0 dBm
*Att 10 dB
*SWT 75 ms
MODULATION SPECTRUM LIST
Frequency 1.00000 GHz
Status FAILED
Ext Attenu 0.0 dB
No of Bursts: 10
Ref Pwr -30.00 dBm at RBW: 30 kHz PBW: 30 kHz VBW: 30 kHz
1 AV AVG
GAT TRG
Offset Freq | *Offset | -Limit | -Offset | -Limit | Status
[kHz] | [dB] | [dB] | [dB] | [dB]
100 17.4 20.5 16.2 20.5 PASSED
200 -12.1 * -10.0 -12.2 -10.0 MARGIN
250 -15.1 * -13.0 -15.4 * -13.0 MARGIN
400 -40.7 * -40.0 -41.6 * -40.0 MARGIN
600 -43.0 * -46.0 -43.5 * -46.0 *FAILED*
800 -46.8 * -46.0 -45.8 * -46.0 *FAILED*
1000 -46.7 * -46.0 -48.2 * -46.0 MARGIN
1200 -47.8 * -46.0 -48.8 * -46.0 MARGIN
1400 -48.5 * -46.0 -49.2 * -46.0 MARGIN
1600 -48.6 * -46.0 -51.1 * -46.0 MARGIN
1800 -49.5 -46.0 -51.5 -46.0 PASSED
Center 1 GHz
360 kHz/
Span 3.6 MHz
SPECTRUM
SCREEN B
START REF MEAS

Figure 2-14 Results of time domain measurement

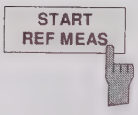
Press the *LIST RESULTS* softkey to view the most recent results in the time domain measurement.

IEC/IEEE bus commands

```
FETCh:SPECtrum:MODulation:REFerence?
FETCh:SPECtrum:MODulation[:ALL]? ARFCn
```

Press the *PAGE UP* softkey to browse through the results table if it is too long to fit onto one page (depending on span).

Press the *PAGE DOWN* softkey to browse through the results table if it is too long to fit onto one page (depending on span).



Press the START REF MEAS softkey to start reference measurement. It determines the reference for the relative measured values and for the limit lines. Depending on the level obtained in this way, a brief message appears, drawing your attention to the optimum reference level. This permits optimum loading of the spectrum analyzer.

Details of reference measurement:

The purpose of reference measurement is to define the reference for the limit values. Averaging is always over at least 20 bursts, irrespective of the number of bursts (*NO. OF BURSTS= SWEEP COUNT*) selected for measurement as such.

The purpose of reference measurement is to determine the reference level for measurement of the spectrum due to modulation. If measurement is successful, the reference power is saved. The resolution bandwidth used for measurement is also saved (the preset bandwidth is 30 kHz). If the result is not tolerable (see below), a warning is issued, but the measured value is used nevertheless. If the operation is cancelled by the user, the reference power is not changed.

If reference measurement is successful, the measured level is displayed and the limit line positioned relative to it (the Y offset parameter of the limit line is recalculated).
Once determined in this way, the reference level is retained either until a preset is performed (default reference level = -20 dBm), or until a new reference measurement is started.

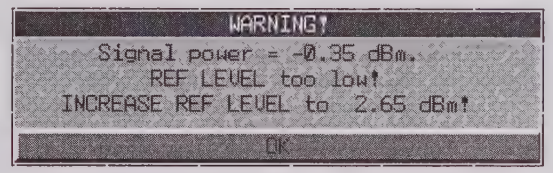
IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt 20
READ:SPECtrum:MODulation:REFerence[:IMMediate]?
```

If the reference level is too low, i.e.

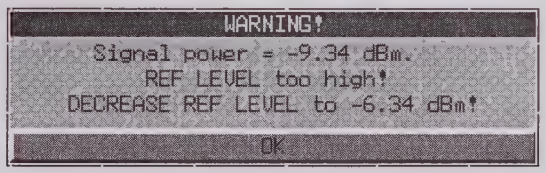
Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > lower level limit - 3 dB

the following message is issued:



The Carrier Overload Bit in IEC/IEEE bus status management is set.

If the reference level is too high, i.e.
Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > upper level limit - 3 dB
the following message is issued:



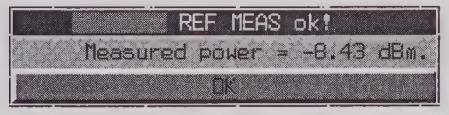
The No Carrier Bit in IEC/IEEE bus status management is set.

The "lower level limit" and "upper level limit" values depend on the selected bandwidth:

Level limit \ RBW	≤30 kHz	100 kHz	≥300 kHz
Lower level limit	-7 dB	-5 dB	+1 dB
Upper level limit	-13 dB	-11 dB	-5 dB

Values between 30 kHz and 100 kHz and between 100 kHz and 300 kHz are mapped to near-match values from the table.

When the reference level is within the valid range, the following message is issued:



The expected power of the DUT is 3 dB below the reference level. If the settings are not compliant with the above, there is a risk either of the analyzer being overloaded or of the maximum dynamic range not being utilized.

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically as described below; all other settings are taken from the GSM/EDGE mode:

Trigger offset = OFF
Trigger = GSM trigger
Gating = OFF

IEC/IEEE bus command `INSTrument[:SELect] SANalyzer`

Test hints

Increasing measurement speed

The measurement speed is considerably increased by using one of the two methods described above (method1 & 2).
This applies for manual as well as for remote control and for both measurement types (frequency sweep and list mode).

The best performance is obtained when the display output is switched off during remote control.

The commands of this subsystem are used for measuring the power at a list of frequency points with different device settings. The measurement is always performed in the time domain (span = 0 Hz).

A new trigger event is required for each test point (exception: Trigger FREE RUN).

The results are output as a list in the order of the entered frequency points. The number of results per test point depends on the number of concurrently active measurements (peak/RMS/average).

Selection of concurrently active measurements and setting of parameters that are constant for the whole measurement is via a configuration command (`SENSe:LIST:POWer:SET`). This also includes the setting for trigger and gate parameters.

The following setting parameters can be selected independently for each frequency point:

- Analyzer frequency
- Reference level
- RF attenuation
- RF attenuation
- RF attenuation of attenuator (only with option B25)
- Resolution filter
- Resolution bandwidth
- Video bandwidth
- Measurement time
- Detector

For details see manual of instrument, chapter "Remote Control – Command Description", section "SENSe:LIST Subsystem".

Example:

```
// Script for MODULATION SPECTRUM MEASUREMENT
//  with user set frequencies.

// Assumes the following Signal:
// 1 GHz, GSM Signal with 0 dBm Power, External Trigger available
// Slot     0   1   2   3   4   5   6   7
// Power    off on  off off off off off off
// TSC      -   1   -   -   -   -   -   -


//Reset Device
*RST

//Switch to Single Sweep
INIT:CONT    OFF

//Set Center Frequency
FREQ:CENTER                1.0GHZ
```

```
//Set Level 3 dB above expected Signal Power
//Precise value is measured with the auto level and
//time function below
DISP:WIND:TRAC:Y:SCAL:RLEVEL 3 DBM

//Switch to GSM Mode
INST MGSM

//Set GSM Trigger mode to external and specifiy
//time from ext Trigger to begin of virtual slot
//0 is used for unknown value which is measured
//with the auto level and time function below
TRIG:SEQ:SYNC:ADJ:EXT 0S

//Set the Trainings Sequence
CONF:CHAN:TSC 1

//Do Auto level and Time measurement.
//(Attention: Correct TSC, Modulation type GSM/EDGE and Multislot
// settings necessary for successful termination of Auto Level and Time )
//If the values for Reference LEVEL and Time for ext Trigger
//to begin of slot are already known, this measurement
//can be skipped.
READ:AUTO:LEVTIME?
//returns: Status, Signal Power, Time between Trigger and begin of virtual
slot, Trig. Level, reserved
//Example: PASSED, -0.37, 6.0300000e-004, 1.4, 0

//Select Spectrum due to modulation measurement which adjusts the trigger
// hold off
//for modulation spectrum purpose
CONF:SPEC:MOD

//Read out the Time between ext. Trigger and begin Modulation Measurement
// Time begin Mod = Time between Trigger and begin of virtual slot + 340us +
// SyncToSlot* 576,92us
// The SyncToSlot is 0 if only one slot is measured. See Multislot Settings.
TRIG:HOLD?
//Example: 0.000943S

//Do the reference Measurement
READ:SPEC:MOD:REF?
//Example -7.78042,0.219582,30000
//The first value -7.78 dBm is the modulation reference level

//Read out the Reference Level in dBm
DISP:WIND:TRAC:Y:SCAL:RLEVEL?
//Example: 2.6

//Read out the RF manual attenuation in dB
INP:ATT?
//Example: 15

//Switch on the sense list power command
//the <trigger offset> is the value Time between ext. Trigger and begin Mo-
// dulation Measurement
//the <gate length> is 170 us according to GSM Spec
//Parameters: <PEAK meas>,<RMS meas>,<AVG meas>,<trigger mode>,<trigger slo-
// pe>,<trigger offset>,<gate length>
LIST:POW:SET OFF, OFF, ON, EXT, POS, 943US, 170 US

//Do the list power measurement:
//<analyzer freq>,<ref level>,<rf att>,<el att>,<filter type>,
//<rbw>,<vbw>,<meas time>,<trigger level>,...
//Explanation:  <analyzer freq> is the carrier frequency -/+ offset values
//              <ref level>     is the read out reference Level, if analyzer
//                               freq 800kHz or more away from
//                              carrier the value can be reduced by 10 dB to
```

```
//                                  increase dynamic
//              <rf att>            is the read out rf manual att value
//              <el att>            0 (if device supports el att, read out the
//                                   value also before List meas)
//              <filter type>       NORMAL
//              <rbw>               30kHz, if analyzer freq 1800kHz or more away
//                                   from carrier 100 kHz
//              <vbw>               30kHz, if analyzer freq 1800kHz or more away
//                                   from carrier 100 kHz
//              <meas time>         number of sweeps * <gate length> , with 20
//                                   sweeps -> 3.4 MS
//              <trigger level>     0 (dummy parameter)
// List for the following freq: -6000, -1800, -1200, -600, -400, -250, -200,
// +200, +250, +400, +600, +1200, +1800, +6000
// in kHz from Carrier 1 GHz:
LIST:POW? 0.994GHZ,    -7.4DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS, 0,
          0.9982GHZ,   -7.4DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS, 0,
          0.9988GHZ,   -7.4DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS, 0,
          0.9994GHZ,    2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS, 0,
          0.9996 GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          0.99975 GHZ, 2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          0.9998 GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0002 GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.00025GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0004GHZ,    2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0006GHZ,    2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0012GHZ,   -7.4DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0018GHZ,   -7.4DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS,0,
          1.006 GHZ,    2.6DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS,0
// The results are the absolute levels in dBm
// Example: -6000 -84.5517272949,
//          -1800 -84.1594314575,
//          -1200 -89.9604415894,
//          - 600 -86.0749740601,
//          - 400 -77.7151641846,
//          - 250 -48.4437561035,
//          - 200 -44.0330238342,
//          + 200 -43.6994476318,
//          + 250 -49.1217575073,
//          + 400 -78.8327560425,
//          + 600 -85.5941925049,
//          +1200 -90.5564193726,
//          +1800 -84.2997055054,
//          +6000 -82.7216644287
// If the modulation reference level (-7.79 dBm) is substracted from these
results the relative value can be compared against the limit for that
frequency:
// eg. -250KHz Offset: -48.44 - (-7.79) = -40.65 dB < -33.0 dB Limit ->
Check is Passed

//Attention! Switch back to Spectrum due to modulation measurement
//to obtain the overview measurement again!
CONF:SPEC:MOD
```

Transducer factors

The FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Measuring with slow frequency hopping

Bear the following in mind when the DUT is operating in slow frequency hopping mode:

1) If an external trigger signal is used, it should trigger the spectrum analyzer only when a burst is sent on the frequency set at the spectrum analyzer.
2) In principle, the IF trigger can be used. Note, however, that its trigger threshold is pegged (-16 dBm at the input mixer). This means that the level of the signal must be high enough to trigger measurement.

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see spectrum analyzer manual). You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Additional information

The tables below show the default settings that apply after you press the *FREQUENCY SWEEP* or *START LIST* softkey.

FREQUENCY SWEEP measurement:

Parameter	Setting	Note
MODE	Frequency sweep, span 3.6 MHz	
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	30 kHz, NORM	3 dB sweep filters are used.
VBW	30 kHz	Coupling off
SWT	75 ms	Time from GSM standard
GATED TRIGGER	ON	
GATE MODE	Edge	
GATE DELAY GSM TRIGGER: Extern GSM TRIGGER: IF Power	 = GSM external trigger offset + 340 µs = GSM IF trigger offset + 340 µs	340 µs is a value from GSM standard: 50% to 90% excluding midamble (see Figure 1-1 in Chapter 1).
GATE LENGTH	170 µs	Value from GSM standard
TRACE 1	AVERAGE	
DETECTOR 1	LOG AVERAGE	
TRACE 2	BLANK	
TRACE 3	BLANK	
Limit Line	MODU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y relative to reference level
Limit Checks	ON	
Limit X OFFSET	0	0, because symmetrical with CF
Limit Y OFFSET	Reference measurement result – (REF LEVEL + REF LEVEL OFFSET)	The limit lines are corrected with the result of the reference measurement.

LIST measurement:

Parameter	Setting	Note
SWEEP COUNT	Taken from Frequency Sweep, changed to 10 if 0	
MODE	Zero Span	reduced presentation
RBW	selectable; default is 30 kHz	
VBW	selectable; default is 30 kHz	
SWT	170 µs	
REF LEVEL POSITION	100%	Preset value
TRIGGER OFFSET GSM-Trigger :Extern GSM-Trigger : IF Power	 = GSM external trigger offset + 340 µs = GSM IF trigger offset + 340 µs	
TRACE 1	AVERAGE	
DETECTOR 1	Average	
TRACE 2, 3	Not possible	
Limit Line	MODU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y relative to reference level

Availability of keys and softkeys

Parameter	Availability	Note
FFT filter (FILTER TYPE FFT)	Function not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Channel and adjacent channel power measurements (CHAN POWER / ACP)	Function not available	
Measurement of occupied bandwidth (OCCUPIED BANDWIDTH)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Unit (UNIT menu)	Function not available	
Linear scaling (RANGE LINEAR)	Function not available	

Measurement of spectrum due to transients

The spectrum due to transients is defined as the spectrum that results from carrier modulation and switching of the burst signal. This spectrum is measured with the aid of the Max Peak detector and Max Hold. The assumption is that the spectrum due to switching of the burst signal is the more significant.

The FS-K5 offers two different ways of measuring the spectrum due to transients:

- General measurement in the frequency domain (*FREQUENCY SWEEP*) and
- Measurement of the spectrum due to transients in the time domain with discrete frequencies (± n x 200 kHz from carrier frequency) and output of the measured values in a list (the *START LIST* softkey).

The measured values can be checked against absolute or relative limit lines.

Requirements for the measuring signal

The frame pattern should include at least one rising and one falling edge.

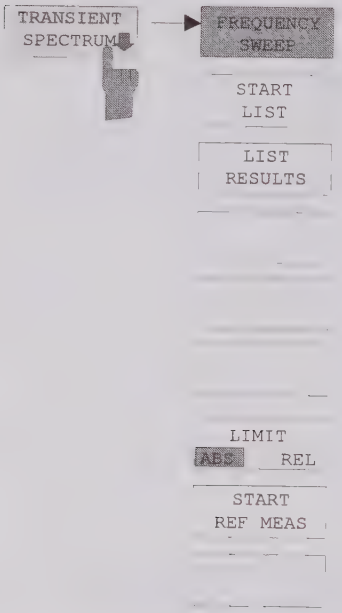
Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	**Operation**
Set frequency	FREQ key
Start application	GSM/EDGE hotkey
Enter external attenuation Default: 0 dB	*GENERAL SETTINGS* softkey *EXTERNAL ATTEN* softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey or *REF LEVEL* softkey → Position burst in mask
Start measurement	*START LIST* softkey

Measurement

GSM/EDGE menu



Press the *TRANSIENT SPECTRUM* softkey to call the submenu for measuring the spectrum due to transients. In the default setting, the SPECTRUM ANALYZER measures the spectrum due to transients in the frequency domain (*FREQUENCY SWEEP*).

Alternatively and precisely in accordance with the standard, *START LIST* can be used to measure in the time domain. In this mode, the SPECTRUM ANALYZER measures the spectrum due to transients in the time domain at the frequency offsets required by the GSM standard and presents the results in list form. You can use *LIST RESULTS* at any time to view the most recent measurement in the time domain.

When the *TRANSIENT SPECTRUM* menu is opened for the first time, the parameters are set in accordance with the GSM standards (see Additional information for other settings):

Span	3.6 MHz
Resolution bandwidth	30 kHz
Video bandwidth	100 kHz
Detector/trace	Max peak, max hold
Sweep time	2.5s
Sweep count	0 (floating trace averaging)

The settings correspond to those made when the *FREQUENCY SWEEP* softkey is pressed. The parameter settings can be changed.
They are not reset until you exit TRA measurement (by starting another measurement or exiting the GSM/EDGE), or press the *FREQUENCY SWEEP* softkey.

When you start list measurement (*START LIST*), the parameter settings used are those currently valid (with the exception of SPAN).

Press the *LIMIT ABS / REL* softkey to toggle between absolute and relative (dependent on pre- measurement) limits.

Press the *FREQUENCY SWEEP* softkey to start continuous measurement of the spectrum due to transients in the "Continuous Sweep" mode (see Figure 2-15).

All the parameters used in TRA measurement are reset to their default values (see above, the *TRANSIENT SPECTRUM* softkey).

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:SPECtrum:SWITching.[:IMMediate]
SWEep:COUNt 20
INITiate:IMMediate; *WAI
CALCulate1:LIMit1:NAME 'TRAU_G'
CALCulate1:LIMit1:FAIL?
```

Note: *In remote-control mode, the user must assign the following name to the limit line before it is used:*
`CALCulate1:LIMit1:NAME 'TRAU_G' or 'TRAU_E'`

Figure 2-15 Spectrum due to transients in frequency domain

Press the *START LIST* softkey to start measurement of the spectrum due to transients in the time domain (Zero Span).

The analyzer measures at the following pegged offsets from the channel frequency:
± 400 kHz, ± 600 kHz, ± 1200 kHz, ± 1800 kHz.

You can choose the resolution bandwidth, but note that this bandwidth is reset to 30 kHz when you press the *FREQUENCY SWEEP* softkey.

Measurement is performed in the time domain with the MAX PEAK detector. The video signal, digitized on the intermediate frequency and filtered with a bandwidth of 30 kHz and bandwidth-limited by the video filter, is measured by the max peak detector during the selected time. The time depends on the number of averages required (*SWEEP COUNT*= number of TDMA bursts to be averaged).

While measurement is in progress, the measured values at the various frequency offsets are displayed briefly in the measurement diagram. The curve reflects progress through the measurement procedure (see Figure 2-16).

In the GSM standards, the mobile's power class is the decisive factor for selecting the right limit line. Consequently, the limit lines specified here are definitive.

When the measuring sequence is completed, the results are displayed in list form (see Figure 2-17). The values marked with an x violate the margin. The values marked with an asterisk (*) violate the limit value.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:SPECtrum:SWITching.[:IMMediate]
SWEep:COUNt 20
READ:SPECtrum:SWITching.[:IMMediate]
```

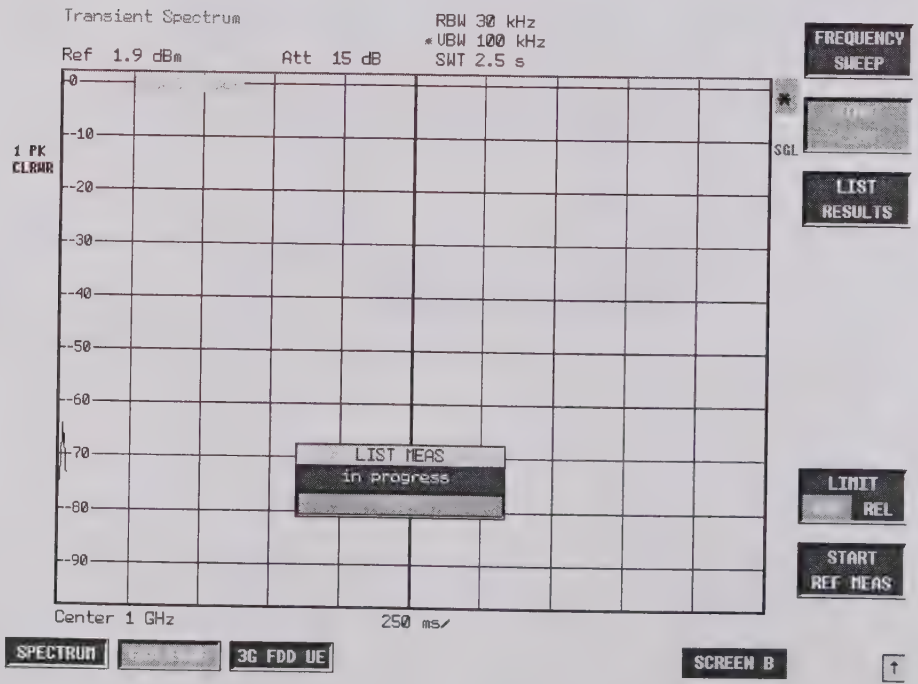


Figure 2-16 Time domain measurement in progress

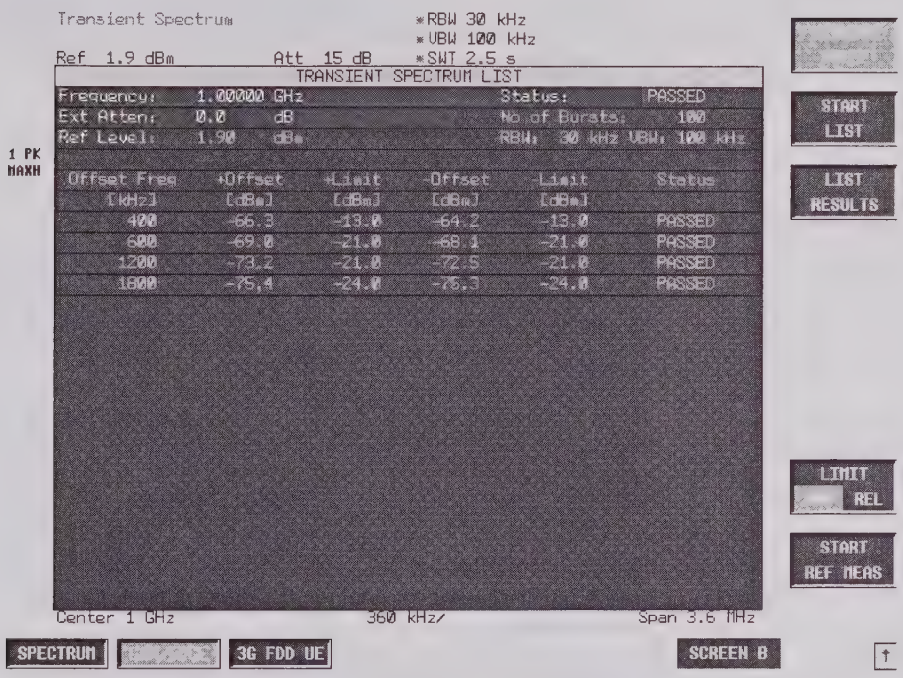
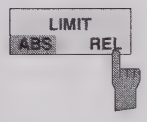


Figure 2-17 Results of time domain measurement

Press the *LIST RESULTS* softkey to view the most recent results in the list of measurements trigged by *START LIST*.

IEC/IEEE bus command `FETCh:SPECtrum:SWITching[:ALL]?`



With the softkey *LIMIT ABS/REL* is toggled between absolute and relative (pre-measurement dependent) limits.

IEC/IEEE bus command

```
CONFigure:SPECtrum:SWITching:LIMit RELative
```

Press the START REF MEAS softkey to start reference measurement. It determines the reference for the relative measured values and for the limit lines. Depending on the level obtained in this way, a brief message appears, drawing your attention to the optimum reference level. This permits optimum loading of the spectrum analyzer.

IEC/IEEE bus command

```
READ:SPECtrum:SWITching:REFerence[:IMMediate]?
```

Details of reference measurement:

The purpose of reference measurement is to define the reference for the limit values. Averaging is always over at least 20 bursts, irrespective of the number of bursts (*NO. OF BURSTS= SWEEP COUNT*) selected for measurement as such.

The purpose of reference measurement is to determine the reference level for measurement of the spectrum due to modulation. If measurement is successful, the reference power is saved. The resolution bandwidth used for measurement is also saved (the preset bandwidth is 30 kHz). If the result is not tolerable (see below), a warning is issued, but the measured value is used nevertheless. If the operation is cancelled by the user, the reference power is not changed.

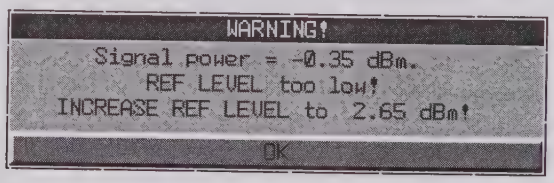
If reference measurement is successful, the measured level is displayed and the limit line positioned relative to it (the Y offset parameter of the limit line is recalculated).

Once determined in this way, the reference level is retained either until a preset is performed (default reference level = -20 dBm), or until a new reference measurement is started.

If the reference level is too low, i.e.

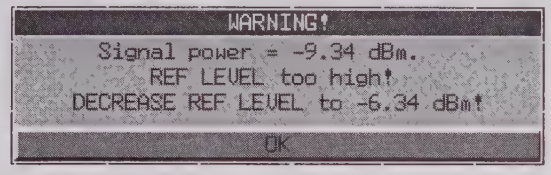
Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > lower level limit - 3 dB

the following message is issued:



The Carrier Overload Bit in IEC/IEEE bus status management is set.

If the reference level is too high, i.e.
Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > upper level limit - 3 dB
the following message is issued:



The No Carrier Bit in IEC/IEEE bus status management is set.

The "lower level limit" and "upper level limit" values are:

lower level limit	+4dB
upper level limit	-5dB

When the reference level is within the valid range, the following message is issued:

The expected power of the DUT is 3 dB below the reference level. If the settings are not compliant with the above, there is a risk either of the analyzer being overloaded or of the maximum dynamic range not being utilized.

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Trigger offset = OFF
Trigger = GSM trigger

IEC/IEEE bus command `INSTrument[:SELect] SANalyzer`

Test hints

Measuring with slow frequency hopping

Bear the following in mind when the DUT is operating in slow frequency hopping mode:

- The default sweep time ensures that at least one frame is recorded for each pixel of the screen. This sweep time must be increased by a factor of three if the hopping period is three frames (B M T).

Increasing measurement speed

In manaual control, the measurement speed is considerably increased by using the two methods described for the MOD measurement. In remote control, the measurement speed is considerably increased by using the SENSe:MPOWer subsystem.

The commands of this subsystem are used for measuring the power at a list of frequency points with different device settings. The measurement is always performed in the time domain (span = 0 Hz).

A new trigger event is required for each test point (exception: Trigger FREE RUN).

The results are output as a list in the order of the entered frequency points. The number of results per test point depends on the number of concurrently active measurements (peak/RMS/average).

Selection of concurrently active measurements and setting of parameters that are constant for the whole measurement is via a configuration command (`SENSe:LIST:POWer:SET`). This also includes the setting for trigger and gate parameters.

The following setting parameters can be selected independently for each frequency point:

- Analyzer frequency
- Reference level
- RF attenuation
- RF attenuation
- RF attenuation of attenuator (only with option B25)
- Resolution filter
- Resolution bandwidth
- Video bandwidth
- Measurement time
- Detector

For details see manual of instrument, chapter "Remote Control – Command Description", section "SENSe:LIST Subsystem".

Optimizing the Sweep Time

The set sweep time can be reduced if more than one slot is active (multislot operation).

Example:

Measurement 1: Frame-Pattern: 10000000 („1" Slot active, „0" Slot inactive)
Sweep time ≥ 2.5 sec (FSP), ≥ 2.9 sec (FSU)

Measurement 2: Frame:Pattern: 10101010 („1" Slot aktiv, „0" Slot inactive)
Sweep time ≥ 2.5/4 sec (FSP), ≥ 2.9/4 sec (FSU)

The sweep time required by the FSE for transient measurements is longer since the FSU display has more pixels than that of the SPECTRUM ANALYZER.

Transducer factors

The FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Additional information

The tables below show the default settings that apply after you press the *FREQUENCY SWEEP* or *START LIST* softkey.

FREQUENCY SWEEP measurement:

Parameter	Setting	Note
MODE	Frequency sweep span 3.6 MHz	
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	30 kHz, NORM	3 dB sweep filters are used.
VBW	100 kHz	(Coupling off)
SWT	2.5 s	At least 1 frame per pixel: 4.6154 ms * 501 = 2.31s
TRIG	FREE RUN	
TRACE 1	MAX HOLD	
DETECTOR 1	MAX PEAK	
TRACE 2	BLANK	
TRACE 3	BLANK	
Limit Line	TRAU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y absolute level Y offset has no effect
Limit Checks	ON	
Limit X OFFSET	0	0, because symmetrical with CF
Limit Y OFFSET	0	No effect, because Y absolute

LIST measurement:

Parameter	Setting	Note
SWEEP MODE	SINGLE	
SWEEP COUNT	Use as is, set to 10 if 0	
SPAN	ZERO SPAN	
TRIG	FREE RUN	
RBW	Selectable; default is 30 kHz	
VBW	Selectable; default is 100 kHz	
SWEEP TIME	Sweep time/501 (FSP) Sweep time/625 (FSU)	In other words list measurement is dependent on the sweep time of the frequency sweep
REF LEVEL POSITION	100%	Preset value
Y axis	LOG_100DB	
TRACE 1	MAX HOLD	
DETECTOR 1	MAX PEAK	
TRACE 2, 3	All settings possible	
Limit Line	TRAU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y absolute level Y offset has no effect
Marker 1	Normal marker on trace 1	

Availability of keys and softkeys

Parameter	Availability	Note
FFT filter (FILTER TYPE FFT)	Function not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Channel and adjacent channel power measurements (CHAN POWER / ACP)	Function not available	
Measurement of occupied bandwidth (OCCUPIED BANDWIDTH)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Unit (UNIT menu)	Function not available	
Linear scaling (RANGE LINEAR)	Function not available	

Measurement of spurious

Measuring spurious entails examining the entire frequency band (30 MHz to 12.75 GHz or upper frequency limit of the analyzer) for interference.

Note: *The center frequency is changed automatically and restored to its original level when measurement is completed.*

Requirements for the measuring signal

All slots active (if, for example, only one slot is active, the measuring time must be extended by a factor of eight).

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	**Operation**
Start application	*GSM/EDGE* hotkey
Enter external attenuation Default: 0 dB	*GENERAL SETTINGS* softkey *EXTERNAL ATTEN* softkey
Fine-tune level to within approx. 1 dB	*AUTO LEVEL&TIME* softkey or *REF LEVEL* softkey → Position burst in mask In case of measurements far off the carrier the reference level can be reduced further.
Start measurement	*PREV* hotkey *SPURIOUS* softkey

Measurement

GSM/EDGE menu

SPURIOUS

The *SPURIOUS* softkey starts measurement of the spurious in the frequency sweep (30 MHz to 12.75 GHz).
The limit lines are displayed.

IEC/IEEE bus commands

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:SPURious[:IMMediate]
SWEep:COUNt 20
INITiate:IMMediate; *WAI
```

Result queries:

```
CALCulate:MARKer ON
CALCulate:MARKer:MAXimum
CALCulate:MARKer:MAXimum:NEXT
(the marker is at the largest spurious emission)
CALCulate:MARKer:MAXimum
```

Figure 2-18 Measurement of spurious

SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Center frequency = The center frequency set before spurious measurements commenced is restored.

Trigger = GSM trigger

IEC/IEEE bus command `INSTrument[:SELect] SANalyzer`

Test hints

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see User Manual). You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Transducer factors

The FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Additional information

Parameter	Setting	Note
MODE	Frequency sweep	
SWEEP MODE	CONT under local control SINGLE under remote control	
START FREQ	30 MHz	In other words the center frequency is changed with this SPU measurement setting
STOP FREQ	Minimum of 12.75 GHz and the max. stop frequency of the analyzer	
RBW	1 MHz	
VBW	3 MHz	
SWT	(5 s / 3.97 GHz) * SPAN	
REf LEVEL POSITION	100%	Preset value
TRIG	Free Run	
TRACE 1	MAX HOLD	
DETECTOR 1	MAX PEAK	
TRACE 2	BLANK	
DETECTOR 2		
TRACE 3	BLANK	
DETECTOR 3		
Limit Line	SPUU_G	X abs. frequency, so X offset has no effect Y abs. level, so Y offset has no effect
Limit Checks	OFF	
Limit X OFFSET	0	No effect, because X absolute
Limit Y OFFSET	0	No effect, because Y absolute

Availability of keys and softkeys

Parameter	Availability	Note
FFT filter (FILTER TYPE FFT)	Function not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Channel and adjacent channel power measurements (CHAN POWER / ACP)	Function not available	
Measurement of occupied bandwidth (OCCUPIED BANDWIDTH)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Time domain mode (ZERO SPAN)	Function not available	Measurement is in frequency domain
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	

Contents - Chapter 6 "Remote Control"

3 Remote Control 3.1

Description of Commands 3.1

CALCulate:DELTamarker Subsystem 3.1

CALCulate:LIMit Subsystem 3.2

CALCulate:MARKer Subsystem 3.3

CALCulate:MARKer:COUNt Subsystem 3.3

CALCulate:MARKer:FUNCtion Subsystem 3.3

CALCulate:MARKer:FUNCtion:POWer Subsystem 3.4

CALCulate:MARKer:FUNCtion:SUMMary Subsystem 3.4

CALCulate:STATistics Subsystem 3.4

CALCulate:UNIT Subsystem 3.4

CONFigure Subsystem 3.5

CONFigure:BURSt Subsystem 3.9

CONFigure:SPECtrum Subsystem 3.11

CONFigure:SPURious Subsystem 3.13

DISPlay Subsystem 3.14

FETCh Subsystem 3.15

FETCh:BURSt Subsystem 3.15

FETCh:PTEMplate Subsystem 3.30

FETCh:SPECtrum Subsystem 3.30

INSTrument Subsystem 3.33

READ Subsystem 3.34

READ:AUTO - Subsystem 3.34

READ:BURSt Subsystem 3.35

READ:SPECtrum Subsystem 3.50

SENSe Subsystem 3.53

SENSe:BANDwidth Subsystem 3.53

SENSe:CORRection Subsystem 3.53

SENSe:DETector Subsystem 3.53

SENSe:FREQuency Subsystem 3.54

SENSe:LIST Subsystem 3.54

SENSe:MPOWer Subsystem 3.55

SENSe:POWer Subsystem 3.55

SENSe:SWEep Subsystem 3.55

STATus Subsystem 3.56

General Trace Commands 3.57

TRACe:IQ Subsystem 3.58

TRIGger Subsystem 3.59

UNIT Subsystem 3.60

Alphabetical List of Commands 3.61

Table of Softkeys and Hotkeys with IEC/IEEE-Bus Command Assignment 3.66

Hotkey GSM/EDGE 3.66

LINES Key 3.69

Status Reporting Registers for GSM/EDGE Measurements 3.70

Overview of Status Registers 3.70

STATus:QUEStionable Register 3.71

STATus-QUEStionable:SYNC Register 3.72

3 Remote Control

The following sections are to complete and update Chapters 5 and 6 of the user manual.
The "Description of Commands" section includes the new commands valid especially for the FS-K5 application, and all commands not available or available only with restrictions in the GSM/EDGE mode.
Commands come in alphabetical order in separate lists in the "List of Commands" section.
The "Status Reporting Registers for GSM/EDGE Measurements" section provides information on the bit assignment in the STATus:QUEStionable and STATus:QUEStionable:SYNC registers.

The FS-K5 commands were generated with a view to maximum compatibility with those of the FSE-K10/FSE-K11/FSE-K20/FSE-K21 applications for the FSE family. Some commands were included in the command set only for reasons of compatibility.

In the description of measurements in Chapter 2, the corresponding IEC/IEEE-bus commands are stated for each softkey.

Note: *All GSM/EDGE measurements are performed in screen A. Therefore, commands carrying a numerical suffix selecting the screen should start either with the numerical suffix 1 (i.e.* `CALCulate1`*) or without a numerical suffix (i.e.* `CALCulate`*).*

Description of Commands

CALCulate:DELTamarker Subsystem

CALCulate<1|2>:DELTamarker<1...4>:FUNCtion:PNOise[:STATe] ON | OFF

Note: *This command is not available in GSM/EDGE mode.*

CALCulate<1|2>:DELTamarker<1...4>:FUNCtion:PNOise:RESult?

Note: *This command is not available in GSM/EDGE mode.*

CALCulate:LIMit Subsystem

Note: *- This command is not available for GSM/EDGE measurements MAC and PFE.*

- The names of the limit lines are fixed. The names must be assigned by the user prior to their use:

```
CALCulate1:LIMit1:NAME 'xxxU_yz' or
CALCulate1:LIMit2:NAME 'xxxL_yz'

        xxx  = measurement            (PVT / CPW / MOD /TRA)
        U    = upper limit line       (PVT / CPW / MOD / TRA)
        L    = lower limit line       (PVT / CPW)
        y    = modulation type        (_G = GMSK / _E = EDGE)
        z    = for all measurements blank, only
               for PVT in multislot:
               active slots           (blank = 1 active slot
                                       2     = 2 active slots
                                       3     = 3 active slots
                                       4     = 4 active slots)
Query:       CALC1:LIM1:FAIL?
             CALC1:LIM2:FAIL?

Example:
CPWU_G =     upper limit line for Carrier Power measurement,
             Modulation type GMSK
PVTL_E3 =    lower limit line for Power versus Time measurement,
             Modulation type EDGE, multislot: 3 active slots
```

CALCulate:MARKer Subsystem

CALCulate:MARKer:COUNt Subsystem

CALCulate<1|2>:MARKer<1...4>:COUNt ON | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:COUNt:RESolution 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:COUNt:FREQuency?

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate:MARKer:FUNCtion Subsystem

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown <numeric_value>

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:STATe ON | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:RESult?

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:FREQuency?

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NOISe[:STATe] ON | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NOISe:RESult?

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:TOI[:STATe] ON | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:TOI:RESult?

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW.*

CALCulate:MARKer:FUNCtion:POWer Subsystem

Note : *The commands of this subsystem are not available in GSM/EDGE mode.*

CALCulate:MARKer:FUNCtion:SUMMary Subsystem

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MODE ABSolute | RELative

Note: *This command is not available for GSM/EDGE measurements MAC and PFE.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:REFerence:AUTO ONCE

Note: *This command is not available for GSM/EDGE measurements MAC and PFE.*

CALCulate:STATistics Subsystem

Note : *The commands of this subsystem are not available in GSM/EDGE mode.*

CALCulate:UNIT Subsystem

Note : *This command is not available in GSM/EDGE mode.*
In GSM measurements the unit is prescribed: either DBM (power measurement) or DEG (phase error measurement) have to be used.

CONFigure Subsystem

The CONFigure subsystem contains commands for configuring complex measurement tasks, like those provided by the firmware application GSM/EDGE Analyzer (FS-K5). The CONFigure subsystem is closely linked to the functions of the FETCH and READ subsystems, where the measurement cycles are started and/or the results of the measurements are queried.

The purpose of the following commands is configuring the GSM/EDGE mode (firmware application FS-K5) for mobiles and base stations corresponding to the standards P-GSM, E-GSM, R-GSM, DCS1800 or PCS1900.

Note: *Beside the notation* `CONFigure:<command>` *the spectrum analyzer also supports the notation* `CONFigure:MS:<command>` *for reasons of compatibility with the FSE family of instruments.*

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			Option FS-K5
:CHANnel			
:SLOT			
:MULTi	ACT1SYNC1 | ACT2SYNC1 | ACT2SYNC2 | ACT3SYNC1 | ACT3SYNC2 | ACT3SYNC3 | ACT4SYNC1 | ACT4SYNC2 | ACT4SYNC3 | ACT4SYNC4 | ACT8SYNC1 | ACT8SYNC2 | ACT8SYNC3 | ACT8SYNC4 | ACT8SYNC5 | ACT8SYNC6 | ACT8SYNC7 | ACT8SYNC8		
:TSC	<numeric_value>| USER	--	
:USER	<string>	--	
:PRATe	4 | 8	--	
:RESTore	--		no query
:MTYPe	GMSK | EDGE		

CONFigure:CHANnel:SLOT:MULTi

ACT1SYNC1 | ACT2SYNC1 | ACT2SYNC2 | ACT3SYNC1 | ACT3SYNC2 | ACT3SYNC3 | ACT4SYNC1 | ACT4SYNC2 | ACT4SYNC3 | ACT4SYNC4 | ACT8SYNC1 | ACT8SYNC2 | ACT8SYNC3 | ACT8SYNC4 | ACT8SYNC5 | ACT83SYNC6 | ACT8SYNC7 | ACT8SYNC8

This command defines the used slots of the mobile or base station. The multislot setting defines how many adjacent slots are active and which of the active slots should be used for synchronization.

The following combinations are possible:

ACT1SYNC1	1 active slot	synchronization to 1st active slot
ACT2SYNC1	2 active slots	synchronization to 1st active slot
ACT2SYNC2	2 active slots	synchronization to 2nd active slot
ACT3SYNC1	3 active slots	synchronization to 1st active slot
ACT3SYNC2	3 active slots	synchronization to 2nd active slot
ACT3SYNC3	3 active slots	synchronization to 3rd active slot
ACT4SYNC1	4 active slots	synchronization to 1st active Slot
ACT4SYNC2	4 active slots	synchronization to 2nd active slot
ACT4SYNC3	4 active slots	synchronization to 3rd active slot
ACT4SYNC4	4 active slots	synchronization to 4th active slot
ACT8SYNC1	8 active slots	synchronization to 1st active Slot
ACT8SYNC2	8 active slots	synchronization to 2nd active Slot
ACT8SYNC3	8 active slots	synchronization to 3rd active Slot
ACT8SYNC4	8 active slots	synchronization to 4th active Slot
ACT8SYNC5	8 active slots	synchronization to 5th active Slot
ACT8SYNC6	8 active slots	synchronization to 6th active Slot
ACT8SYNC7	8 active slots	synchronization to 7th active Slot
ACT8SYNC8	8 active slots	synchronization to 8th active Slot

For the phase-frequency error, modulation accuracy and power vs. time measurement the midamble (trainingssequence) for the slot to synchronize must be set correctly!

The reference measurement of power vs. time measurement and the questionable signal power of the main measurement is related to the slot to synchronize. In the main measurement of power vs. time the slot to synchronize defines the synchronization point of the multislot signal on the screen. All results of the phase-frequency error and modulation accuracy measurement are related to the slot to synchronize.
In carrier power and modulation spectrum measurement the slot to synchronize is used to adjust the triggerdelay in order that the slot to synchronize is measured.

With the slot to synchronize it is therefore possible to investigate a certain slot of multislot signals.

This command is only available with the GSM/EDGE Analyzer FS-K5 option.

Example:
```
"INST MGSM"                    Switches the instrument to GSM/EDGE mode
"CONF:CHAN:SLOT:MULTI ACT3SYNC2"
                               Selects the multislot configuration with
                               3 adjacent active slots and
                               synchronization on the 2nd (middle)
```

Features: *RST-value: ACT1SYNC1 (one slot active)
SCPI: device-specific

Mode: GSM/EDGE

CONFigure:CHANnel:TSC <numeric_value> | USER

This command selects the midamble used by the mobile or base station. With selection USER, the user defined midamble set with command `CONFigure:CHANnel:TSC:USER` is used. It is only available in GSM/EDGE mode (FS-K5).

Note: *The selected midamble is only significant for GSM/EDGE measurements MAC, PFE and PVT.*

Parameter: <numeric_value> ::= 0...7 (training sequence for normal burst)
USER (the TSC set with `CONF:CHAN:TSC:USER` is used)

Example:
```
"INST MGSM"                    ' Switches instruement to GSM/EDGE mode
"CONF:CHAN:TSC 3"              ' Selects TSC 3
```

Features: *RST value: 0
SCPI: device-specific

Mode: GSM/EDGE

CONFigure:CHANnel:TSC:USER <string>

This command defines the bit pattern of the user midamble (training sequence). The user midamble is selected with command `CONF:CHAN:TSC USER`.
For each modulation type, a separate user midamble can be defined.

Parameter: <string> **For modulation type GMSK:**
The first 26 characters are evaluated.
'0' and '1' represent the GMSK symbols -1 and 1.
If the number of characters is insufficient, the string is filled with '0' up to the 26th character. Characters other than '0' are processed as '1'.

For modulation type 8PSK (EDGE):
The first 78 characters are evaluated. The character patterns are assigned to the 8PSK (EDGE) symbols as follows:

Pattern	8PSK Symbol
111	0
011	1
010	2
000	3
001	4
101	5
100	6
110	7

If the number of characters is insufficient, the string is filled with '0' up to the 78th character . Characters other than '0' are processed as '1'.

Example:

```
"INST MGSM"              Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"         Selects modulation type GMSK
"CONF:CHAN:TSC:USER '0101010101010101010101010101'"
                         Defines TSC USER for GMSK
"CONF:CHAN:TSC USER"     Selects TSC USER.
"CONF:MTYP EDGE"         Selects modulation type EDGE (8PSK)
"CONF:CHAN:TSC:USER '0101010101010101010101010101
1010101010101010101010101010101010101010101010101010101'"
                         Defines TSC USER for EDGE
```

Features: *RST value: '000000000000000000000000000000' for GMSK, 78 times '0' for 8PSK (EDGE) accordingly
SCPI: device-specific

Mode: GSM/EDGE

CONFigure:PRATe 4 | 8

This command defines the number of measurement points per symbol. (rate of points per symbols).

Example:

```
"INST MGSM"              'Switches the instrument to GSM/EDGE mode
"CONF:PRAT 8"            'Defines the points per symbol rate to 8'
```

Characteristics: *RST- value: 4
SCPI: device-specific

Mode: GSM/EDGE

CONFigure:RESTore

This command restores the GSM/EDGE limit lines. Any modifications made to the GSM/EDGE limit lines are lost and the status upon delivery is restored.
This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"
"CONF:REST"
```

Switches the instrument to GSM/EDGE mode
restores the GSM/EDGE limit lines

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:MTYPe GMSK | EDGE

This command selects modulation typeGMSK or EDGE.
A running GSM measurement is aborted when the modulation type is changed. It has to be explicitly selected again by using one of the `CONFigure` commands.

Example:

```
"INST MGSM"
"CONF:MTYP EDGE"
"CONF:BURS:MACC"
"SWE:COUN 20"
"INIT:IMM;*WAI"
```

Switches the instrument to GSM/EDGE mode
Selects modulation type EDGE (8PSK)
Selects the MAC measurement
Sets the number of bursts
Starts the measurement

Features: *RST value: GMSK
SCPI: device-specific

Mode: GSM/EDGE

CONFigure:BURSt Subsystem

This subsystem provides the commands for configuring the measurements in the GSM/EDGE mode (option FS-K5) which are performed on individual bursts:

- Carrier Power (CPW),
- Modulation Accuracy (MAC),
- Phase-Frequency Error (PFE),
- Power vs. Time (PVT).

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			Option FS-K5
:BURSt			
:PFERror			
[:IMMediate]		--	no query
:MACCuracy			
[:IMMediate		--	no query
:POWer			
[:IMMediate]		--	no query
:PTEMplate			
[:IMMediate]		--	no query
:SELect	FULL | TOP | RISing | FALLing		

CONFigure:BURSt:PFERror[:IMMediate]

This command selects measurement of the phase and frequency error of the mobile or base station (PFE). When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (FS-K5) and when modulation type GMSK is selected (`CONFigure:MTYPe GMSK`).

Example:

`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
`"CONF:MTYP GMSK"`	Selects modulation type GMSK
`"CONF:BURS:PFER"`	Selects the PFE measurement
`"SWE:COUN 20"`	Sets the number of bursts
`"INIT:IMM;*WAI"`	Sxecutes the measurement

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:MACCuracy[:IMMediate]

This command selects measurement of the modulation accuracy of the mobile or base station (MAC). When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (option FS-K5) and when modulation type EDGE (`CONFigure:MTYPe EDGE`) is selected.

Example:

`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
`"CONF:MTYP EDGE"`	Selects modulation type EDGE (8PSK)
`"CONF:BURS:MACC"`	Selects the MAC measurement
`"SWE:COUN 20"`	Sets the number of bursts
`"INIT:IMM;*WAI"`	Starts the measurement

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:POWer[:IMMediate]

This command selects measurement of the carrier power of the mobile or base station (CPW).

When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:BURS:POW"      Selects the CPW measurement
"SWE:COUN 20"        Sets the number of bursts
"INIT:IMM;*WAI"      Executes the measurement
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:PTEMplate[:IMMediate]

This command selects measurement of power of the mobile or base station vs. time (PVT).

When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:BURS:PTEM"     Selects the PVT measurement
"SWE:COUN 20"        Sets the number of bursts
"INIT:IMM;*WAI"      Executes the measurement
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:PTEMplate:SELect FULL | TOP | RISing | FALLing

This command defines the burst section to be measured.

FULL : full burst
RISing : rising edge
FALLing : falling edge
TOP : top high resolution, top of burst with smaller display range and therefore higher resolution on y-axis (power axis)

This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"              Switches the instrument to GSM/EDGE mode
"CONF:BURS:PTEM"         Selects the PVT measurement
"CONF:BURS:PTEM:SEL TOP" Selects the top high resolution mode
"SWE:COUN 20"            Sets the number of bursts
"INIT:IMM;*WAI"          Executes the measurement
```

Features: *RST value: FULL
SCPI: device-specific

Mode: GSM/EDGE

CONFigure:SPECtrum Subsystem

This subsystem provides the commands for configuring the measurements in the in the GSM/EDGE Analyzer mode (FS-K5) used to determine the power of the spectral contributions due to modulation and switching:

- spectrum due to modulation (MOD)
- spectrum due to transients (TRA).

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			Option FS-K5
:SPECtrum			
:MODulation			
[:IMMediate]	--	--	no query
:SWITching			
[:IMMediate]	--	--	no query
:LIMit	ABSolute | Relative		

CONFigure:SPECtrum:MODulation[:IMMediate]

This command selects measurement of the spectrum due to modulation (MOD).

The overview measurement in the frequency domain is directly started with command `INITate[:IMMediate]`, the list measurement in the time domain with command `READ:SPECtrum:MODulation[:ALL]?`.

When the measurement is started the analyzer is automatically set to single sweep. This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:SPEC:MOD"      Selects the MOD measurement
"SWE:COUN 20"        Sets the number of bursts
"INIT:IMM;*WAI"      Executes the overview measurement
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:SPECtrum:SWITching[:IMMediate]

This command selects measurement of the spectrum due to switching transients (TRA).

The overview measurement in the frequency domain is directly started with command `INITate[:IMMediate]`, the list measurement in the time domain with command `READ:SPECtrum:MODulation[:ALL]?`.

When the measurement is started the analyzer is automatically set to single sweep. This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:SPEC:SWIT"     Selects the TRA measurement
"SWE:COUN 20"        Sets the number of bursts
"INIT:IMM;*WAI"      Executes the overview measurement
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:SPECtrum:SWITching:LIMit

This command selects the type of limit check of the measurement of the spectrum due to switching transients (TRA). Default is the test against the absolute (ABS) limit line `TRAU_G` or `TRAU_E` depending on the modulation type (GSM/EDGE).
If the limit type REL is selected, the relative limit line `TRRU_G` or. `TRRU_E` depending on the modulation type (GSM/EDGE) is used for the check.
For the relative measurement exists the necessary reference measurement `READ:SPEC:SWIT` which determines the reference power.
This command is only available in GSM/EDGE mode (FS-K5).

Example:

```
"INST MGSM"                 'Switches the instrument to GSM MS mode
"CONF:SPEC:SWIT"            'Selects the TRA measurement
"CONF:SPEC:SWIT:LIM REL"    'Selects relative measurement type
"SWE:COUN 20"               'Sets the number of bursts
"READ:SPEC:SWIT:REF?"       'Starts the reference measurement
"INIT:IMM;*WAI"             'Executes the overview measurement
```

Characteristics: *RST value: REL
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and therefore has no query and no *RST value .

CONFigure:SPURious Subsystem

This subsystem provides commands for configuring the measurements in the GSM/EDGE (FS-K5) Analyzer mode used for measuring the power of spurious emissions (SPU).

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure :SPURious [:IMMediate]	--	--	Option FS-K5 no query

CONFigure:SPURious[:IMMediate]

This command selects measurement of spurious emissions (SPU).

When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (FS-K5)

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:SPUR"          Selects the SPU measurement
"SWE:COUN 20"        Sets the number of bursts
"INIT:IMM;*WAI"      Executes the overview measurement
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

DISPlay Subsystem

DISPlay:FORMat SINGle | SPLit

Note : *This command is not available in GSM/EDGE mode. For GSM/EDGE mode, the display is always set to FULL SCREEN.*

DISPlay[:WINDow<1|2>]:SELect

Note : *This command is not available in GSM/EDGE mode.*
In GSM/EDGE mode, the display is always set to FULL SCREEN, which corresponds to SCREEN A and thus to `WINDow1. WINDow1` *is automatically selected when the GSM/EDGE mode is activated with command* `INSTrument:SELect:MGSM`.

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LINear | LOGarithmic

Note : *This command is not available in GSM/EDGE mode.*

FETCh Subsystem

The FETCh subsystem contains commands for reading out results of complex measurement tasks like those provided by the GSM/EDGE mode (FS-K5). The FETCh subsystem is closely linked to the functions of the CONFigure and READ subsystems, where the measurement sequences are configured, the measurements are started and their results are queried.

FETCh:BURSt Subsystem

This subsystem provides the commands for reading out results of measurements in GSM/EDGE (option FS-K5) Analyzer mode, which are performed on individual bursts without starting the measurement by themselves:
Phase-Frequency Error (PFE), Modulation Accuracy (MAC), Power vs Time (PVT),

COMMAND	PARAMETER	UNIT	COMMENT
FETCh			Option FS-K5
:BURSt			
:PERRor			
:RMS			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:PEAK			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:FERRor			
:AVERage?	--	Hz	query only
:MAXimum?	--	Hz	query only
:IQOFfset			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:IQIMbalance			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:PTEMplate			
:REFerence?	--	--	query only
:TRGS			
:AVERage?	--	s	query only
:MAXimum?	--	s	query only
:MACCuracy			
:RMS			
:AVERage?			query only
:MAXimum?	--		query only
:PEAK	--		
:AVERage?			query only
:MAXimum?	--		query only
:OSUPpress	--		
:AVERage?			query only
:MAXimum?	--		query only
:PERCentile	--		
:AVERage?			query only
:MAXimum?	--		query only
:FREQuency	--		
:AVERage?			query only
:MAXimum?	--		query only
:IQOFfset	--		
:AVERage?			query only
:MAXimum?	--		query only
:IQIMbalance	--		
:AVERage?			query only
:MAXimum?	--		query only
	--		

FETCh:BURSt:PERRor:RMS:AVERage?

This command reads out the average of the RMS measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: `"INST MGSM"` Switches the instrument to GSM/EDGE mode

`"CONF:MTYP GMSK"`	Selects the modulations type GMSK
`"CONF:BURS:PFER"`	Selects the PFE measurements
`"SWE:COUN 20"`	Sets the number of bursts
`"INIT:IMM;*WAI"`	Executes the measurement
`"FETC:BURS:PERR:RMS:AVER?"`	Queries the result

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:RMS:MAXimum?

This command reads out the maximum of the RMS measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: `"INST MGSM"` Switches the instrument to GSM/EDGE modeModus

`"CONF:MTYP GMSK"`	Selects the modulation type GMSK
`"CONF:BURS:PFER"`	Selects the PFE measurements
`"SWE:COUN 20"`	Sets the number of bursts
`"INIT:IMM;*WAI"`	Executes the measurement
`"FETC:BURS:PERR:RMS:MAX?"`	Queries the result

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:PEAK:AVERage?

This command reads out the average of the PEAK measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                    Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"               Selects the modulation type GMSK
"CONF:BURS:PFER"               Selects the PFE measurement
"SWE:COUN 20"                  Sets the number of bursts
"INIT:IMM;*WAI"                Executes the measurement
"FETC:BURS:PERR:PEAK:AVER?"    Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:PEAK:MAXimum?

This command reads out the maximum of the PEAK measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                    Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"               Selects the modulation type GMSK
"CONF:BURS:PFER"               Selects the PFE measurement
"SWE:COUN 20"                  Sets the number of bursts
"INIT:IMM;*WAI"                Executes the measurement
"FETC:BURS:PERR:PEAK:MAX?"     Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:FERRor:AVERage?

This command reads out the average of the frequency error measurement taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	Selects the PFE measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the measurement
	`"FETC:BURS:FERR:AVER?"`	Queries the result
Features:	*RST value: --	
	SCPI: device-specific	
Mode:	GSM/EDGE	

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:FERRor:MAXimum?

This command reads out the maximum of the frequency error measurement taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	Selects the PFE measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the measurement
	`"FETC:BURS:FERR:MAX?"`	Queries the result
Features:	*RST value: --	
	SCPI: device-specific	
Mode:	GSM/EDGE	

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQOFfset:AVERage?

This command reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"              'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"         'Selects the modulation type GMSK
"CONF:BURS:PFER"         'Selects the PFE measurement
"SWE:COUN 20"            'Sets the number of bursts
"INIT:IMM;*WAI"          'Executes the measurement
"FETC:BURS:IQOF:AVER?"   'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQOFfset:MAXimum?

This command reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"              'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"         'Selects the modulation type GMSK
"CONF:BURS:PFER"         'Selects the PFE measurement
"SWE:COUN 20"            'Sets the number of bursts
"INIT:IMM;*WAI"          'Executes the measurement
"FETC:BURS:IQOF:MAX?"    'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQIMbalance:AVERage?

This command reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"              'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"         'Selects the modulation type GMSK
"CONF:BURS:PFER"         'Selects the PFE measurement
"SWE:COUN 20"            'Sets the number of bursts
"INIT:IMM;*WAI"          'Executes the measurement
"FETC:BURS:IQIM:AVER?"   'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQIMbalance:MAXimum?

This command reads out the maximum of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"              'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"         'Selects the modulation type GMSK
"CONF:BURS:PFER"         'Selects the PFE measurement
"SWE:COUN 20"            'Sets the number of bursts
"INIT:IMM;*WAI"          'Executes the measurement
"FETC:BURS:IQIM:MAX?"    'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PTEMplate:REFerence?

This command reads out the results of the premeasurement of power vs. time (PVT). The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>: measured level

<Level2>: level corrected by means of the bandwidth

<RBW>: bandwidth

This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see `:CONFigure:BURSt:PTEMplate`).

Example:

```
"INST MGSM"              Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"         Selects the modulation type GMSK
"CONF:BURS:PTEM"         Selects the PVT measurement
"READ:BURS:PTEM:REF?"    Executes the premeasurement
"FETC:BURS:PTEM:REF?"    Queries the result
```

Result: 43.2,43.2,1000000

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PTEMplate:TRGS:AVERage?

This command reads out the average of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts. (TRGS: TRiGger to Start symbol of midamble)
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) or TOP HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:

```
"INST MGSM"                    'Switches the instrument to GSM MS mode
"TRIG:SEQ:SYNC:ADJ:EXT 0S"     'select GSM Trigger extern
"CONF:BURS:PTEM"               'Selects power vs. time (PVT)
"SWE:COUN 20"                  'Sets the number of bursts
"INIT:IMM;*WAI"                'Executes the measurement
"FETC:BURS:PTEM:TRGS:AVER?"    'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and therefore has no query and no *RST value .

FETCh:BURSt:PTEMplate:TRGS:MAXimum?

This command reads out the maximum of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts. (TRGS: TRiGger to Start symbol of midamble)
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) or TOP HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:

```
"INST MGSM"                  'Switches the instrument to GSM MS mode
"TRIG:SEQ:SYNC:ADJ:EXT 0S"   'select GSM Trigger extern
"CONF:BURS:PTEM"             'Selects power vs. time (PVT)
"SWE:COUN 20"                'Sets the number of bursts
"INIT:IMM;*WAI"              'Executes the measurement
"FETC:BURS:PTEM:TRGS:MAX?"   'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and therefore has no query and no *RST value .

FETCh:BURSt:MACCuracy:RMS:AVERage?

This command reads out the average of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                  Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"             Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"             Selects the MAC measurement
"SWE:COUN 20"                Sets the number of bursts
"INIT:IMM;*WAI"              starts the measurement
"FETC:BURS:MACC:RMS:AVER?"   Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:RMS:MAXimum?

This command reads out the maximum of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:RMS:MAX?"   Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PEAK:AVERage?

This command reads out the average of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:PEAK:AVER?" Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PEAK:MAXimum?

This command reads out the maximum of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:PEAK:MAX?"  Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:OSUPpress:AVERage?

This command reads out the average of the original offset supression measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:OSUP:AVER?" Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:OSUPpress:MAXimum?

This command reads out the maximum of the original offset supression measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                    Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"               Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"               Selects the MAC measurement
"SWE:COUN 20"                  Sets the number of bursts
"INIT:IMM;*WAI"                Starts the measurement
"FETC:BURS:MACC:OSUP:MAX?"     Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PERCentile:AVERage?

This command reads out the average of the 95% percentile measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                    Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"               Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"               Selects the MAC measurement
"SWE:COUN 20"                  Sets the number of bursts
"INIT:IMM;*WAI"                Starts the measurement
"FETC:BURS:MACC:PERC:AVER?"    Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PERCentile:MAXimum?

This command reads out the maximum of the 95% percentile measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:PERC:MAX?"  Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:FREQuency:AVERage?

This command reads out the average of the frequency error measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:FREQ:AVER?" Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:FREQuency:MAXimum?

This command reads out the maximum of the frequency error measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            Selects the MAC measurement
"SWE:COUN 20"               Sets the number of bursts
"INIT:IMM;*WAI"             Starts the measurement
"FETC:BURS:MACC:FREQ:MAX?"      Queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQOFfset:AVERage?

This command reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            'Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            'Selects the MAC measurement
"SWE:COUN 20"               'Sets the number of bursts
"INIT:IMM;*WAI"             'Starts the measurement
"FETC:BURS:MACC:IQOF:AVER?"     'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQOFfset:MAXimum?

This command reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:
```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            'Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            'Selects the MAC measurement
"SWE:COUN 20"               'Sets the number of bursts
"INIT:IMM;*WAI"             'Starts the measurement
"FETC:BURS:MACC:IQOF:MAX?"  'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQIMbalance:AVERage?

This command reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:
```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"            'Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"            'Selects the MAC measurement
"SWE:COUN 20"               'Sets the number of bursts
"INIT:IMM;*WAI"             'Starts the measurement
"FETC:BURS:MACC:IQIM:AVER?" 'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQIMbalance:MAXimum?

This command reads out the maximum of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (see `CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                    'Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"               'Selects modulation type EDGE (8PSK)
"CONF:BURS:MACC"               'Selects the MAC measurement
"SWE:COUN 20"                  'Sets the number of bursts
"INIT:IMM;*WAI"                'Starts the measurement
"FETC:BURS:MACC:IQIM:MAX?"     'Queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:PTEMplate Subsystem

Note: *This subsystem has been included only for reasons of compatibility with FSE-K10. It is replaced by the command* `FETCh:BURSt:PTEMplate:REFerence?`. *For a detailed description see command* `FETCh:BURSt:PTEMplate:REFerence?`.

COMMAND	PARAMETER	UNIT	COMMENT
FETCh			Option FS-K5
:PTEMplate			
:REFerence?	--	--	query only

FETCh:SPECtrum Subsystem

This subsystem provides the commands for reading out results of measurements in the GSM/EDGE (FS-K5) mode, used to measure the power of the spectral contributions due to modulation and switching without first restarting a new measurement.
Spectrum due to modulation(MOD)
Spectrum due to transient (TRA)

COMMAND	PARAMETER	UNIT	COMMENT
FETCh			Option FS-K5
:SPECtrum			
:MODulation			
[:ALL?]	ARFCn	--	query only
:REFerence?	--	--	query only
:SWITching			
[:ALL?]	--	--	query only

FETCh:SPECtrum:MODulation[:ALL]? ARFCn

This command reads out the result of the measurement of the modulation spectrum of the mobile or base station.

Parameter: ARFCn::= ARFCN ± 1.8 MHz

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the parts between '[...]' denote a partial result string that can be repeated n times.

<Index>: 0, if the partial result string characterizes a measurement range

current number <>0,
if the partial result string characterizes a single limit excess.

<Freq1>: Start frequency of the measurement range or frequency where the limit line is exceeded

<Freq2>: Start frequency of the measurement range or frequency exceeding the measurement range. The value of <Freq2> is equal to the value of <Freq1>, if either the measurement is performed in the time domain or if the partial result string contains a limit excess.

<Level>: Measured maximum level of the partial range or

measured level at the test point.

<Limit>: Limit in the partial range or at the test point

<Abs/Rel>: ABS <Level> and <Limit> are in absolute units (dBm)
REL <Level> and <Limit> are in relative units (dB)

<Status>: Result of the limit check in character data form:

PASSED	no limit exceeded
FAILED	limit exceeded
MARGIN	margin exceeded
EXC	limit excess marked as an exception

The frequencies <Freq1> and <Freq2> are always absolute, i. e. not referred to the carrier frequency.

This command is only available in GSM/EDGE mode (FS-K5) and when modulation spectrum measurement is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:

`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
`"CONF:SPEC:MOD"`	Selects the MOD measurement
`"READ:SPEC:MOD:REF?"`	Executes the premeasurement and queries the result
`"READ:SPEC:MOD?"`	Executes the measurement in the time domain and queries the result
`"FETC:SPEC:MOD? ARFCn"`	Queries the result of the measurement in the time domain without starting a new measurement

Result:

```
0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:SPECtrum:MODulation:REFerence?

This command reads out the results of the premeasurement of modulation due to spectrum measurement.

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:
<Level1>,<Level2>,<RBW>

<Level1>: measured level
<Level2>: level corrected by means of the bandwidth
<RBW>: bandwidth

This command is only available in GSM/EDGE mode (FS-K5) and when the measurement of the modulation due to spectrum is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:

```
"INST MGSM"              Switches the instrument to GSM/EDGE mode
"CONF:SPEC:MOD"          Selects the MOD measurement
"READ:SPEC:MOD:REF?"     Executes the premeasurement and queries
                         the result
"FETC:SPEC:MOD:REF?"     Queries the result of the premeasurement
                         without starting a new measurement
```

Result: 35.2,43.2,30000

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:SPECtrum:SWITching[:ALL]?

This command reads out the result of the measurement of the transient spectrum of the mobile or base station.

The result is output as a list of partial result strings separated by ',' as for the command `FETCh:SPECtrum:MODulation[:ALL]?`.

This command is only available in GSM/EDGE mode (FS-K5) and when modulation spectrum measurement is selected (see `:CONFigure:SPECtrum:SWITching`).

Example:

```
"INST MGSM"              Switches the instrument to GSM/EDGE mode
"CONF:SPEC:SWIT"         Selects the TRA measurement
"READ:SPEC:SWIT?"        Executes the measurement in the time
                         domain and queries the result
"FETC:SPEC:SWIT?"        Queries the result without starting a new
                         measurement
```

Result:

```
0,833.4E6,833.4E6,37.4,-36.0,ABS,MARGIN,
1,834.0E6,834.0E6,-35.2,-36.0,ABS,FAILED,
2,834.6E6,834.6E6,-74.3,-75.0,REL,FAILED
0,835.0E6,835.0E6,-65,0,-60.0,REL,PASSED
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers. The measurement windows are assigned to INSTrument1 (screen A) and INSTrument2 (screen B).

COMMAND	PARAMETER	UNIT	COMMENT
INSTrument<1|2>			
[:SELect]	SANalyzer | MGSM		Option FS-K5
:NSELect	1 | 5		Option FS-K5

INSTrument<1|2>[:SELect] SANalyzer | MSGM

Parameter: SANalyzer: Spectrum analyzer mode
MGSM: GSM/EDGE analyzer for mobile and base station tests

Example: `"INST SAN"` Switches the instrument to spectrum analyzer mode

Features: *RST value: SANalyzer
SCPI: conforming

Mode: all

Changeover to MGSM is only possible with firmware application GSM/EDGE (FS-K5) installed.

Notes on GSM/EDGE mode:

- *After switchover to the GSM/EDGE mode, a measurement has to be selected by means of a CONFigure command.*
- *After switchover to the GSM/EDGE mode, the modulation mode (GMSK or EDGE) selected last is active.*
- *If the analyzer is set to external trigger on switchover to GSM/EDGE mode, the 'Extern' GSM trigger is used. If the Analyzer trigger source is 'RF POWER trigger' the GSM trigger 'RF POWER' is selected.*
- *When switching from GSM/EDGE mode to Analyzer mode, the GSM trigger setting is maintained, i.e. IF power if 'IF Power' was set before, RF power if 'RF Power' was set before and external trigger, if 'Extern' was set before.*

INSTrument<1|2>:NSELect 1 | 5

Parameter: 1: Spectrum analyzer mode
5: GSM/EDGE analyzer for mobile and base station tests

Example: `"INST:NSEL 1"` Switches the instrument to spectrum analyzer mode.

Features: *RST value: 1
SCPI: conforming

Mode: all

Changeover to MGSM is only possible with firmware application GSM/EDGE (FS-K5) installed.

For notes on GSM/EDGE mode see above.

READ Subsystem

The READ subsystem contains commands for starting complex measurement tasks such as those provided in the GSM/EDGE mode (FSE-K5), and for querying the results subsequently. The READ subsystem is closely linked to the functions of the CONFigure and FETCh subsystems, where the measurement sequences are configured or the results are queried without restarting a new measurement.

READ:AUTO - Subsystem

This subsystem contains commands for starting automatic measurement routines for the GSM/EDGE mode (FS-K5). The analyzer will automatically being adjusted to the input signal.

COMMAND	PARAMETERS	UNIT	COMMENT
READ			
:AUTO			Option FS-K5
:LEVTime?	--		query only

READ:AUTO:LEVTime?
This command starts a measurement sequence which automatically adjusts the level and trigger timing of the input signal to the analyzer. Preconditions are a correct setting of center frequency and a correct choice of the GSM trigger source to be utilised. (refer to command `TRIG:SEQ:SYNC:ADJ;` 0 sec should be used for the time between trigger and begin of slot)

The result is read out as a list of partial ASCII result strings separated by ',' in the following format:
<status>,<signal power>,<time from trigger to begin of slot>,<trigger level>,<reserved>

<status>:	status: PASSED		measurement successful, result figures are valid
	FAILED		measurement failed, result figures are invalid error (e.g. no carrier) can be read out of the status reporting system
<signal power>	signal power	dBm	(reference level is automatically set 3 dB above the signal power)
<time trigger to virtual begin of slot>		s	correction value for the time offset between the currently active GSM trigger and beginning of the slot.
<trigger level>		dBm/V	trigger level of the currently active GSM trigger, for IF/RF the units are dBm, for external trigger the unit is Volts
<reserved>			always 0, for future use

After the automatic sequence a GSM measurement must be selected again with the command `CONFigure`.
The premeasurement for power vs. time is executed implicitly within the sequence.
For modulation spectrum measurement the premeasurement must be executed again.
This command is only available in GSM/EDGE mode (FS-K5).

Example:

`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
`"CONF:MTYP GMSK"`	Selects modulation type GMSK
`"FREQ:CENT 890.2E6"`	Sets the center frequency
`"TRIG:SYNC:ADJ:EXT 0s"`	Selects GSM external trigger!
`"READ:AUTO:LEVTime?"`	Executes the measurement and queries the result

Result: PASSED,8.3,6.15E-005,1.4,0

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt Subsystem

This subsystem provides the commands for starting measurements in the GSM/EDGE Analyzer mode (option FS-K5), which are performed on individual bursts and for reading out the results subsequently: Phase-Frequency Error (PFE), Modulation Accuracy (MAC), Power vs. Time (PVT)

COMMAND	PARAMETER	UNIT	COMMENT
READ			Option FS-K5
:BURSt			
:PERRor			
:RMS			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:PEAK			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:FERRor			
:AVERage?	--	Hz	query only
:MAXimum?	--	Hz	query only
:IQOFfset			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:IQIMbalance			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:PTEMplate			
:REFerence			
[:IMMediate?]	--	--	query only
:TRGS			
:AVERage?	--	s	query only
:MAXimum?	--	s	query only
:REFerence			
[:IMMediate?]	--	--	query only
:MACCuracy			
:RMS	--	%	query only
:AVERage?	--	%	query only
:MAXimum?			
:PEAK	--	%	query only
:AVERage?	--	%	query only
:MAXimum?			
:OSUPpress	--	dB	query only
:AVERage?	--	dB	query only
:MAXimum?			
:PERCentile	--	%	query only
:AVERage?	--	%	query only
:MAXimum?			
:FREQuency	--	Hz	query only
:AVERage?	--	Hz	query only
:MAXimum?			
:IQOFfset	--	%	query only
:AVERage?	--	%	query only
:MAXimum?			
:IQIMbalance	--	%	query only
:AVERage?	--	%	query only
:MAXimum?			

READ:BURSt:PERRor:RMS:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the RMS measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                  Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"             Selects modulation type GMSK
"CONF:BURS:PFER"             Selects the PFE measurement
"SWE:COUN 20"                Sets the number of bursts
"READ:BURS:PERR:RMS:AVER?"   Executes the measurement and queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:RMS:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the maximum of the RMS measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                  Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"             Selects modulation type GMSK
"CONF:BURS:PFER"             Selects the PFE measurement
"SWE:COUN 20"                Sets the number of bursts
"READ:BURS:PERR:RMS:MAX?"    Executes the measurement and queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:PEAK:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the PEAK measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: Switches the instrument to GSM/EDGE mode

```
"INST MGSM"
"CONF:MTYP GMSK"          Selects modulation type GMSK
"CONF:BURS:PFER"          Selects the PFE measurement
"SWE:COUN 20"             Sets the number of bursts
"READ:BURS:PERR:PEAK:AVER?"  Executes the measurement and queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:PEAK:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the maximum of the PEAK-measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer automatically is set to single sweep.
Further results of the PFE measurement can be then queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`

Example: Switches the instrument to GSM/EDGE mode

```
"INST MGSM"
"CONF:MTYP GMSK"          Selects modulation type GMSK
"CONF:BURS:PFER"          Selects the PFE measurement
"SWE:COUN 20"             Sets the number of bursts
"READ:BURS:PERR:PEAK:MAX?"   Executes the measurement and queries the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:FERRor:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the measurement of the frequency error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	Selects modulation type GMSK
	`"CONF:BURS:PFER"`	Selects the PFE measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"READ:BURS:FERR:AVER?"`	Executes the measurement and queries the result

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:FERRor:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the maximum of the measurement of the frequency error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	Selects modulation type GMSK
	`"CONF:BURS:PFER"`	Selects the PFE measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"READ:BURS:FERR:MAX?"`	Executes the measurement and queries the result

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQOFfset:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"            'Selects modulation type GMSK
"CONF:BURS:PFER"            'Selects the PFE measurement
"SWE:COUN 20"               'Sets the number of bursts
"READ:BURS:IQOF:AVER?"      'Executes the measurement and queries the
                            'result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQOFfset:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"            'Selects modulation type GMSK
"CONF:BURS:PFER"            'Selects the PFE measurement
"SWE:COUN 20"               'Sets the number of bursts
"READ:BURS:IQOF:MAX?"       'Executes the measurement and queries the
                            'result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQIMbalance:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"            'Selects modulation type GMSK
"CONF:BURS:PFER"            'Selects the PFE measurement
"SWE:COUN 20"               'Sets the number of bursts
"READ:BURS:IQIM:AVER?"      'Executes the measurement and queries the
                            'result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQIMbalance:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:

```
"INST MGSM"                 'Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"            'Selects modulation type GMSK
"CONF:BURS:PFER"            'Selects the PFE measurement
"SWE:COUN 20"               'Sets the number of bursts
"READ:BURS:IQIM:MAX?"       'Executes the measurement and queries the
                            'result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PTEMplate:REFerence[:IMMediate]?

This command starts the premeasurement of power vs. time and reads out the results.

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>: measured level

<Level2>: level corrected by means of the bandwidth

<RBW>: bandwidth

This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see `:CONFigure:BURSt:PTEMplate`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"            Selects modulation type GMSK
"CONF:BURS:PTEM"            Selects the PVT measurement
"READ:BURS:PTEM:REF?"       Executes the measurement and queries the
                            result
```

Result: 43.2,43.2,600000

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PTEMplate:TRGS:AVERage?

This command starts the measurement of Power vs Time (PVT) of the base station or mobile and reads out the average of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts.
(TRGS: TRiGger to Start symbol of midamble)
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) or TOP HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:

```
"INST MGSM"                  'Switches the instrument to GSM MS mode
"TRIG:SEQ:SYNC:ADJ:EXT 0S"   'select GSM Trigger extern
"CONF:BURS:PTEM"             'Selects power vs. time (PVT)
"SWE:COUN 20"                'Sets the number of bursts
"READ:BURS:PTEM:TRGS:AVER?"  'Executes the measurement and
                             queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and therefore has no query and no *RST value .

READ:BURSt:PTEMplate:TRGS:MAXimum?

This command starts the measurement of Power vs Time (PVT) of the base station or mobile and reads out the maximum of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts.
(TRGS: TRiGger to Start symbol of midamble)
This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) or TOP HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:

```
"INST MGSM"                    'Switches the instrument to GSM MS mode
"TRIG:SEQ:SYNC:ADJ:EXT 0S"     'select GSM Trigger extern
"CONF:BURS:PTEM"               'Selects power vs. time (PVT)
"SWE:COUN 20"                  'Sets the number of bursts
"READ:BURS:PTEM:TRGS:MAX?"     'Executes the measurement and
                               queries the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and therefore has no query and no *RST value .

READ:BURSt:REFerence[:IMMediate]?

This command starts the premeasurement of power vs. time and returns the measured level in dBm.

This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the power vs. time is selected (see `:CONFigure:BURSt:PTEMplate`).

Note:
This command has been included only for reasons of compatibility with FSE-K10.
Instead of this command, the command `READ:BURSt:PTEMplate:REFerence[IMMediate]?` *should be used, whose output format conforms to that of the premeasurement query commands.*
For a detailed description see command `READ:BURSt:PTEMplate:REFerence [IMMediate]?`.

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:MTYP GMSK"     Selects the modulation type GMSK
"CONF:BURS:PTEM"     Selects the PVT measurement
"READ:BURS:REF?"     Executes the premeasurement and queries
                     the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:RMS:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                  Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"             Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"             Selects the MAC measurement
"SWE:COUN 20"                Sets the number of bursts
"READ:BURS:MACC:RMS:AVER?"   Starts the measurement and reads out the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:RMS:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:

```
"INST MGSM"                  Switches the instrument to GSM/EDGE mode
"CONF:MTYP EDGE"             Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"             Selects the MAC measurement
"SWE:COUN 20"                Sets the number of bursts
"READ:BURS:MACC:RMS:MAX?"    Starts the measurement and reads out the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PEAK:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode	`"INST MGSM"`	Switches the instrument to GSM/EDGE
	`"CONF:MTYP EDGE"`	Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	Selects the MAC measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"READ:BURS:MACC:PEAK:AVER?"`	Starts the measurement and reads out the result

Features:	*RST value:	--
	SCPI:	device-specific
Mode:	GSM/EDGE	

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PEAK:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode	`"INST MGSM"`	Switches the instrument to GSM/EDGE
	`"CONF:MTYP EDGE"`	Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	Selects the MAC measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"READ:BURS:MACC:PEAK:MAX?"`	Starts the measurement and reads out the result

Features:	*RST value:	--
	SCPI:	device-specific
Mode:	GSM/EDGE	

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:OSUPpress:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the original offset suppression measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

`"INST MGSM"`	Switches the instrument to GSM/EDGE
`"CONF:MTYP EDGE"`	Selects the modulation type EDGE (8PSK)
`"CONF:BURS:MACC"`	Selects the MAC measurement
`"SWE:COUN 20"`	Sets the number of bursts
`"READ:BURS:MACC:OSUP:AVER?"`	Starts the measurement and reads out the result

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:OSUPpress:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the original offset suppression measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

`"INST MGSM"`	Switches the instrument to GSM/EDGE
`"CONF:MTYP EDGE"`	Selects the modulation type EDGE (8PSK)
`"CONF:BURS:MACC"`	Selects the MAC measurement
`"SWE:COUN 20"`	Sets the number of bursts
`"READ:BURS:MACC:OSUP:MAX?"`	Starts the measurement and reads out the result

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PERCentile:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the 95% percentile measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: Switches the instrument to GSM/EDGE mode

```
"INST MGSM"
```

```
"CONF:MTYP EDGE"          Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"          Selects the MAC measurement
"SWE:COUN 20"             Sets the number of bursts
"READ:BURS:MACC:PERC:AVER?" Starts the measurement and reads out
                          the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PERCentile:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the 95% percentile measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: Switches the instrument to GSM/EDGE mode

```
"INST MGSM"
```

```
"CONF:MTYP EDGE"          Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"          Selects the MAC measurement
"SWE:COUN 20"             Sets the number of bursts
"READ:BURS:MACC:PERC:MAX?" Starts the measurement and reads out the
                          result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:FREQuency:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the frequency error measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

```
"INST MGSM"                          Switches the instrument to GSM/EDGE
"CONF:MTYP EDGE"                     Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"                     Selects the MAC measurement
"SWE:COUN 20"                        Sets the number of bursts
"READ:BURS:MACC:FREQ:AVER?"          Starts the measurement and reags out
                                     the result
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:FREQuency:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the frequency error measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

```
"INST MGSM"                          Switches the instrument to GSM/EDGE
"CONF:MTYP EDGE"                     Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"                     Selects the MAC measurement
"SWE:COUN 20"                        Sets the number of bursts
"READ:BURS:MACC:FREQ:MAX?"           Starts the measurement and reads out
                                     the result.
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQOFfset:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

```
"INST MGSM"                          'Switches the instrument to GSM/EDGE
"CONF:MTYP EDGE"                     'Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"                     'Selects the MAC measurement
"SWE:COUN 20"                        'Sets the number of bursts
"READ:BURS:MACC:IQOF:AVER?"          'Starts the measurement and reags out
                                     'the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQOFfset:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

```
"INST MGSM"                          'Switches the instrument to GSM/EDGE
"CONF:MTYP EDGE"                     'Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"                     'Selects the MAC measurement
"SWE:COUN 20"                        'Sets the number of bursts
"READ:BURS:MACC:IQOF:MAX?"           'Starts the measurement and reads out
                                     'the result.
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQIMbalance:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

```
"INST MGSM"                          'Switches the instrument to GSM/EDGE
"CONF:MTYP EDGE"                     'Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"                     'Selects the MAC measurement
"SWE:COUN 20"                        'Sets the number of bursts
"READ:BURS:MACC:IQIM:AVER?"          'Starts the measurement and reags out
                                     'the result
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQIMbalance:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode

```
"INST MGSM"                          'Switches the instrument to GSM/EDGE
"CONF:MTYP EDGE"                     'Selects the modulation type EDGE (8PSK)
"CONF:BURS:MACC"                     'Selects the MAC measurement
"SWE:COUN 20"                        'Sets the number of bursts
"READ:BURS:MACC:IQIM:MAX?"           'Starts the measurement and reads out
                                     'the result.
```

Characteristics: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum Subsystem

This subsystem provides the commands for starting measurements in the GSM/EDGE mode (FS-K5), which are used to measure the power of the spectral components due to modulation and switching, and for reading out the results subsequently.
Measurement of spectrum due to modulation (MOD)
Measurement of spectrum due to transients (TRA)

COMMAND	PARAMETER	UNIT	COMMENT
READ			Option FS-K5
:SPECtrum			
:MODulation			
[:ALL?]	--	--	query only
:REFerence			
[:IMMediate?]	--	--	query only
:SWITching			
[:ALL?]	--	--	query only
:REFerence			
[:IMMediate?]			

READ:SPECtrum:MODulation[:ALL]?

This command starts the measurement of the modulation spectrum of the base station or mobile and reads out the result. The measurement is performed in the frequency range ARFCN ± 1.8 MHz.

The result is read out as a list of partial ASCII result strings separated by ',' in the following format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the part set in '[...]' characterizes a partial result string which can be repeated n times.

<Index>: 0, if the partial result string characterizes a measurement range.
current number <>0, if the partial result string characterizes a single limit excess.

<Freq1>: Start frequency of the measurement range or frequency where the limit is exceeded.

<Freq2>: Stop frequency of the measurement range or frequency where the measured range is exceeded. The value of <Freq2> is equal to the value of <Freq1>, if either the measurement is performed in the time domain or the partial result string contains a limit excess.

<Level>: Measured maximum level of the partial range or measured level at the test point.

<Limit>: Limit in the partial range or at the test point.

<Abs/Rel>: ABS <Level> and <Limit> are in absolute units (dBm)
REL <Level> and <Limit> are in relative units (dB)

<Status>: Result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded
MARGIN margin exceeded
EXC limited excess characterized as an exception

The frequencies <Freq1> and <Freq2> are always absolute and not referred to the carrier frequency.

An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (FS-K5) option and when modulation spectrum measurement is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:SPEC:MOD"             Selects the MOD measurement
"READ:SPEC:MOD:REF?"        Executes the premeasurement and queries
                            the result.
"READ:SPEC:MOD?"            Executes the measurement in the time
                            domain and queries the result.
```

Result:

```
0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum:MODulation:REFerence[:IMMediate]?

This command starts the premeasurement of the modulation due to spectrum measurement and reads out the result.

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>: measured level

<Level2>: level corrected by means of the bandwidth

<RBW>: bandwidth

This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the modulation due to spectrum is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:

```
"INST MGSM"                 Switches the instrument to GSM/EDGE mode
"CONF:SPEC:MOD"             Selects the MOD measurement
"READ:SPEC:MOD:REF?"        Executes the premeasurement and queries
                            the result.
```

Result: 35.2,43.2,30000

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum:SWITching[:ALL]?

This command starts the measurement of the transient spectrum of the mobile or base station and reads out the result.

The result is read out as a list of partial ASCII result strings separated by ',' in the format used for `READ:SPECtrum:MODulation[:ALL]?`

An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE Analyzer mode (FS-K5) and when the spectrum due to switching measurement is selected (see `:CONFigure:SPECtrum:SWITCHing`)

Example:

```
"INST MGSM"          Switches the instrument to GSM/EDGE mode
"CONF:SPEC:SWIT"     Selects the TRA measurement
"READ:SPEC:SWIT?"    Executes the measurement in the time
                     domain and queries the result.
```

Result:

```
0,833.4E6,833.4E6,37.4,-36.0,ABS,MARGIN,
1,834.0E6,834.0E6,-35.2,-36.0,ABS,FAILED,
2,834.6E6,834.6E6,-74.3,-75.0,REL,FAILED
0,835.0E6,835.0E6,-65,0,-60.0,REL,PASSED
```

Features: *RST value: --
SCPI: device-specific

Mode: GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum:SWITching:REFerence[:IMMediate]?

This command starts the premeasurement of the modulation due to switching transients (TRA) measurement and reads out the result.

This premeasurement is only necessary if the limit type is relative.
(See command `CONF:SPEC:SWIT:LIM`)

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>: measured level

<Level2>: level corrected by means of the bandwidth (RBW is fix 300 kHz, therfore identical to the measured level.)

<RBW>: bandwidth, fix 300 kHz

This command is only available in GSM/EDGE mode (FS-K5) and when measurement of the modulation due to swithcing transients is selected (see `:CONFigure:SPECtrum:SWITching`).

Example:

```
"INST MGSM"              'Switches the instrument to GSM MS mode
"CONF:SPEC:SWIT"         'Selects the TRA measurement
"CONF:SPEC:SWIT:LIM REL" 'Selects relative mode
"SWE:COUN 20"            'Selects number of bursts
"READ:SPEC:SWIT:REF?"    'Executes the premeasurement and queries
                         'the result.
```

Result: 43.2,43.2,300000

Characteristics: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and therefore has no query and no *RST value .

SENSe Subsystem

The SENSe subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.
The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSe" is optional for this reason, which means that it is not necessary to include the SENSe node in command sequences.

SENSe:BANDwidth Subsystem

[SENSe:]BANDwidth|BWIDth[:RESolution] <numeric_value>

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT. The bandwidth is automatically set according to standard GSM.*

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO <numeric_value>

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution]:TYPE NORMal | FFT | CFILter | RRC

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW.*

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo 1Hz...10MHz

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:AUTO ON | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:RATio 0.01...1000

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

SENSe:CORRection Subsystem

Note : *The commands of this subsystem are not available in GSM/EDGE mode.*

SENSe:DETector Subsystem

Note : *Detectors APEAK and QPEak are not available for GSM/EDGE measurements MAC, PFE and PVT.*

SENSe:FREQuency Subsystem

[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK SPAN | RBW | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT*

[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK:FACTor 1 ... 100 PCT

Note: *This command is not available for GSM/EDGE measurements MAC, PFE and PVT*

[SENSe<1|2>:]FREQuency:SPAN 0 .. f_{max}

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:SPAN:FULL

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:STARt 0 .. f_{max}

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:STOP 0 .. f_{max}

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:MODE CW | FIXed | SWEep

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT, CPW and SPU*

SENSe:LIST Subsystem

Note: *The commands of this subsystem are not available for GSM/EDGE measurements MAC, PFE and PVT*

SENSe:MPOWer Subsystem

Note: *The commands of this subsystem are not available for GSM/EDGE measurements MAC, PFE and PVT*

SENSe:POWer Subsystem

Note : *The commands of this subsystem are not available in GSM/EDGE mode.*

SENSe:SWEep Subsystem

[SENSe<1|2>:]SWEep:TIME 2.5 ms to 16000 s (frequency domain) | 1 µs to 16000 s (time domain)

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]SWEep:TIME:AUTO ON | OFF

Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]SWEep:EGATe...

Note: *The commands of this node are not available for GSM/EDGE measurements MAC, PFE, PVT, CPW, TRA and SPU.*

STATus Subsystem

The STATus subsystem contains the commands for the status reporting system. *RST does not influence the status registers. The STATus:QUEStionable:SYNC register comprises information about sync and burst events (see below).

STATus:QUEStionable:SYNC[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:SYNC register. Readout deletes the contents of the EVENt section.

Example: `"STAT:QUES?"`

Features: *RST value: –
SCPI: device-specific

Modes: all

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:SYNC register. Readout does not delete the contents of the CONDition section.

Example: `"STAT:QUES:COND?"`

Features: *RST value: –
SCPI: device-specific

Modes: all

STATus:QUEStionable:SYNC:ENABle 0 to 65535

This command sets the bits of the ENABle section of the STATus:QUEStionable: SYNC register. The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

Example: `"STAT:QUES:ENAB 65535"`

Features: *RST value: –
SCPI: device-specific

Modes: all

STATus:QUEStionable:SYNC:PTRansition 0 to 65535

This command sets the edge detectors of all bits of the STATus:QUEStionable: SYNC register from 0 to 1 for the transitions of the CONDition bit.

Example: `"STAT:QUES:PTR 65535"`

Features: *RST value: –
SCPI: device-specific

Modes: all

STATus:QUEStionable:SYNC:NTRansition 0 to 65535

This command sets the edge detectors of all bits of the STATus:QUEStionable: SYNC register from 1 to 0 for the transitions of the CONDition bit.

Example: `"STAT:QUES:NTR 65535"`

Features: *RST value: –
SCPI: device-specific

Modes: all

General Trace Commands

TRACe<1|2>[:DATA] TRACE1| TRACE2| TRACE3, <block> | <numeric_value>

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. The associated measurement window is selected with the numeric suffix of TRACe<1|2>.

Example:
```
"TRAC TRACE1,"+A$    (A$: data list in the current format)
"TRAC? TRACE1"
```

Characteristics: *RST value: -
SCPI: conforming

Mode: all

Return values:

The parameter of the query is the trace name TRACE1 to TRACE3, it indicates which trace memory will be read out.

The returned values are scaled in the current level unit. In ASCII format, a list of values separated by commas is returned (Comma Separated Values = CSV). The number of measurement points is 501 for FSP, 625 for FSU.

If the transmission takes place using the binary format (REAL,32), the data are transferred in block format (Definite Length Block Data according to IEEE 488.2). They are arranged in succeeding lists of I and Q data of 32 Bit IEEE 754 floating point numbers.

General structure of return string:

FSP: #42004<meas value 1><meas value value2>...<meas value 501>

FSU: #42500<meas value 1><meas value value2>...<meas value 625>

with

#	Head marker of binary data stream
4	ASCII byte stating the length of the subsequent lengthcounter, here 4
2004/2500	Number of data bytes, here 2004 (FSP) / 2500 (FSU)
<meas value x>	4 byte floating point measurement values

Saving and recalling:

Saving and recalling trace data together with the device settings to/from the device-internal hard disk or to/from a floppy is controlled via the commands "MMEMory:STORe:STATe" and "MMEMory:LOAD:STATe" respectively. Trace data are selected with "MMEMory:SELect[:ITEM]:ALL" or ""MMEMory:SELect[:ITEM]:TRACe". Trace data in ASCII format (ASCCII FILE EXPORT) are exported with the command "MMEM:STORe:TRACe".

Transfer format:

The trace data are transferred in the current format (corresponding to the command FORMat ASCii|REAL). The device-internal trace memory is addressed using the trace names 'TRACE1' to 'TRACE3'.
The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred. In ASCII format, these data are values separated by commas. If the transfer takes place using the format real (REAL,32), the data are transferred in block format.

The transfer format for the trace data depends on the instrument setting:

SPECTRUM mode (span > 0 and zero span):

501 (FSP)/ 625 (FSU) results are output in the unit selected for display.

Note: *With AUTO PEAK detector, only positive peak values can be read out. Trace data can be written into the instrument with logarithmic display only in dBm, with linear display only in volts.*

FORMAT REAL,32 is to be used as format for binary transmission.

GSM/EDGE Analyzer:

In power vs. time (PVT) measurement the number of results depends on the number of active slots (from the multislot command `CONF:CHAN:SLOT:MULT`) and it depends also on the points per symbol rate (from command `CONF:CHAN:PRAT`).

	4 points per symbol	8 points per symbol
1 active slot	868 results	1736 results
2 active slots	1492 results	2984 results
3 active slots	2116 results	4232 results
4 active slots	2740 results	5480 results
8 active slots	5240 results	10480 results

In phase-frequency error (PFE) measurement the number of results depends on the points per symbol rate (from command `CONF:CHAN:PRAT`).

4 points per symbol	8 points per symbol
588 results	1176 results

In error vector magnitude (MAC) measurement the number of results depends on the points per symbol rate (from command `CONF:CHAN:PRAT`).

4 points per symbol	8 points per Symbol
568 results	1136 results

The other GSM measurements traces are of the length as in standard SPECTRUM mode.

TRACe:IQ Subsystem

Note : *The commands of this subsystem are not available in GSM/EDGE mode.*

TRIGger Subsystem

Notes: - *When entering the option GSM/EDGE Analyzer (with* `INST:SEL MGSM`*), the following GSM Trigger selection is made:*
If the Analyzer trigger source is 'IF POWER trigger' the GSM trigger 'IF POWER' is selected.
If the Analyzer trigger source is 'Extern trigger' the GSM trigger 'Extern' is selected.
If the Analyzer trigger source is 'RF POWER trigger' the GSM trigger 'RF POWER' is selected.
Otherwise the (default) GSM Trigger' 'IF POWER' is selected.

- *When switching from GSM/EDGE mode to Analyzer mode, the GSM/EDGE trigger setting is maintained, i.e. IF power if 'IF Power' was set before, RF power if 'RF Power' was set before and external trigger, if 'Extern' was set before.*

COMMAND	PARAMETER	UNIT	COMMENT
TRIGger<1|2>			
[:SEQuence]			
:SOURce	IMMediate | EXTernal | VIDeo | IFPower		
:SYNChronize			Option FS-K5
:ADJust			
:EXTernal	<numeric_value>	s	
:IFPower	<numeric_value>	s	
:RFPower	<numeric_value>	s	Option FSP-B6

TRIGger<1|2>[:SEQuence]:SOURce IMMediate | EXTernal | VIDeo | IFPower

Note : *This command is not available in GSM/EDGE mode. The trigger source is selected with commands* `TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:...`.

TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal -460µs...8s

This command is a combination of 2 commands:

For one, the 'Extern' GSM trigger is selected. For all GSM measurements requiring a trigger signal and for which an external trigger is possible, the `EXTernal` trigger setting is used. If an external trigger is not possible, the `IMMediate` trigger setting is used (see table of triggers in section "Trigger and Time References" in Chapter 1.)

For another, the correction value for the time offset of the external trigger from the beginning of the first active slot is defined (GSM trigger offset, see section "Trigger and Time References" in Chapter 1).
This correction value is needed in order to establish an exact time reference between the trigger event and the beginning of the slot if there is no midamble triggering. The correction value for the DUT in question can be determined in the *GENERAL SETTINGS* menu with the *TRIGGER OFFSET* softkey.

This command is available only if GSM/EDGE Analyzer (FS-K5) application firmware is installed.

Example:
```
"INST MGSM"
"TRIG:SYNC:ADJ:EXT 200us"
```
Switches the instrument to GSM/EDGE mode
Selects 'Extern' GSM trigger and a GSM trigger offset of 200 µs between the external trigger and the beginning of the slot.

Features: *RST value: 0s
SCPI: device-specific

Mode: GSM/EDGE

TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower -460µs...8s

This command is a combination of 2 commands:
For one, the 'IF Power' GSM trigger is selected. For all GSM measurements for which an IF power trigger is possible, the `IFPower` trigger setting is used. If an IF power trigger is not possible, the `IMMediate` trigger setting is used (see table of triggers in section "Trigger and Time References" in Chapter 1.)
For another, the correction value for the time offset of the IF power trigger from the beginning of the first active slot is defined (GSM trigger offset, see section "Trigger and Time References" in Chapter 1).
This correction value is needed in order to establish an exact time reference between the trigger event and the beginning of the slot if there is no midamble triggering. The correction value for the DUT in question can be determined in the *GENERAL SETTINGS* menu with the *TRIGGER OFFSET* softkey.
This command is available only if GSM/EDGE Analyzer application firmware (FS-K5) is installed.

Example:
```
"INST MGSM"
"TRIG:SYNC:ADJ:IFP 20us"
```
Switches the instrument to GSM/EDGE mode
Selects 'IF Power' GSM trigger and a GSM trigger offset of 20 µs between the IF power trigger and the beginning of the slot

Features: *RST value: 0s
SCPI: device-specific

Mode: GSM/EDGE

TRIGger[:SEQuence]:SYNChronize:ADJust:RFPower -460µs...8s

This command is a combination of 2 commands:
For one, the 'RF Power' GSM trigger is selected. For all GSM measurements for which an RF power trigger is possible, the `RFPower` trigger setting is used. If an RF power trigger is not possible, the `IMMediate` trigger setting is used (see table of triggers in section "Trigger and Time References" in Chapter 1.)
For another, the correction value for the time offset of the RF power trigger from the beginning of the first active slot is defined (GSM trigger offset, see section "Trigger and Time References" in Chapter 1).
This correction value is needed in order to establish an exact time reference between the trigger event and the beginning of the slot if there is no midamble triggering. The correction value for the DUT in question can be determined in the *GENERAL SETTINGS* menu with the *TRIGGER OFFSET* softkey.
This command is available only if GSM/EDGE Analyzer application firmware (FS-K5) is installed and if the option FSP-B6 (TV- and RF-Trigger) is available.

Example:
```
"INST MGSM"
"TRIG:SYNC:ADJ:RFP 20us"
```
Switches the instrument to GSM/EDGE mode
Selects 'RF Power' GSM trigger and a GSM trigger offset of 20 µs between the RF power trigger and the beginning of the slot

Features: *RST value: 0s
SCPI: device-specific

Mode: GSM/EDGE

UNIT Subsystem

UNIT<1|2>:POWer DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | V | A | W

Note: *This command is not available in GSM/EDGE mode. In GSM/EDGE mode, the unit is fixed, i.e. dBm (for power measurements) or deg (for phase error measurements).*

Alphabetical List of Commands

The following list contains the new commands for application firmware GSM/EDGE, FS-K5

Command	Parameter	Page
CONFigure:BURSt:MACCuracy[:IMMediate]		3.9
CONFigure:BURSt:PFERror[:IMMediate]		3.9
CONFigure:BURSt:POWer[:IMMediate]		3.10
CONFigure:BURSt:PTEMplate:[:IMMediate]		3.10
CONFigure:BURSt:PTEMplate:SELect	FULL | TOP | RISing | FALLing	3.10
CONFigure:CHANnel:SLOT:MULTi	ACT1_SYNC1 | ACT2_SYNC1 | ACT2_SYNC2 | ACT3_SYNC1 | ACT3_SYNC2 | ACT3_SYNC3 | ACT4_SYNC1 | ACT4_SYNC2 | ACT4_SYNC3 | ACT4_SYNC4 | ACT8_SYNC1 | ACT8_SYNC2 | ACT8_SYNC3 | ACT8_SYNC4 | ACT8_SYNC5 | ACT8_SYNC6 | ACT8_SYNC7 | ACT8_SYNC8	3.5
CONFigure:CHANnel:TSC	0 to 7 | USER	3.6
CONFigure:CHANnel:TSC:USER	<string>	3.7
CONFigure:MTYPe	GMSK | EDGE	3.8
CONFigure:PRATe	4 | 8	3.7
CONFigure:RESTore		3.8
CONFigure:SPECtrum:MODulation[:IMMediate]		3.11
CONFigure:SPECtrum:SWITching:LIMit		3.12
CONFigure:SPECtrum:SWITching[:IMMediate]		3.11
CONFigure:SPURious[:IMMediate]		3.13
FETCh:BURSt:FERRor:AVERage?		3.18
FETCh:BURSt:FERRor:IQIMbalance?		3.20
FETCh:BURSt:FERRor:IQOFfset?		3.19
FETCh:BURSt:FERRor:MAXimum?		3.18
FETCh:BURSt:IQIMbalance:MAXimum?		3.20
FETCh:BURSt:IQOFfset:MAXimum?		3.19
FETCh:BURSt:MACCuracy:FREQuency:AVERage?		3.26
FETCh:BURSt:MACCuracy:FREQuency:MAXimum?		3.27
FETCh:BURSt:MACCuracy:IQIMbalance:AVERage?		3.28
FETCh:BURSt:MACCuracy:IQIMbalance:MAXimum?		3.29
FETCh:BURSt:MACCuracy:IQOFfset:AVERage?		3.27
FETCh:BURSt:MACCuracy:IQOFfset:MAXimum?		3.28
FETCh:BURSt:MACCuracy:OSUPpress:AVERage?		3.24
FETCh:BURSt:MACCuracy:OSUPpress:MAXimum?		3.25
FETCh:BURSt:MACCuracy:PEAK:AVERage?		3.23
FETCh:BURSt:MACCuracy:PEAK:MAXimum?		3.24
FETCh:BURSt:MACCuracy:PERCentile:AVERage?		3.25
FETCh:BURSt:MACCuracy:PERCentile:MAXimum?		3.26

Command	Parameter	Page
FETCh:BURSt:MACCuracy:RMS:AVERage?		3.22
FETCh:BURSt:MACCuracy:RMS:MAXimum?		3.23
FETCh:BURSt:PERRor:PEAK:AVERage?		3.17
FETCh:BURSt:PERRor:PEAK:MAXimum?		3.17
FETCh:BURSt:PERRor:RMS:AVERage?		3.16
FETCh:BURSt:PERRor:RMS:MAXimum?		3.16
FETCh:BURSt:PTEMplate:REFerence?		3.21
FETCh:BURSt:PTEMplate:TRGS:AVERage?		3.21
FETCh:BURSt:PTEMplate:TRGS:MAXimum?		3.22
FETCh:MODulation[:ALL]?	ARFCn	3.30
FETCh:PTEMplate:REFerence?		3.30
FETCh:SPECtrum:MODulation:REFerence?		3.32
FETCh:SPECtrum:SWITching[:ALL]?		3.32
INSTrument<1|2>:NSELect	1 | 5	3.33
INSTrument<1|2>[:SELect]	SANalyzer | MGSM	3.33
READ:AUTO:LEVTime?		3.34
READ:BURSt:FERRor:AVERage?		3.38
READ:BURSt:FERRor:IQIMbalance?		3.40
READ:BURSt:FERRor:IQOFfset?		3.39
READ:BURSt:FERRor:MAXimum?		3.38
READ:BURSt:IQIMbalance:MAXimum?		3.40
READ:BURSt:IQOFfset:MAXimum?		3.39
READ:BURSt:MACCuracy:FREQuency:AVERage?		3.47
READ:BURSt:MACCuracy:FREQuency:MAXimum?		3.47
READ:BURSt:MACCuracy:IQOFfset:AVERage?		3.48
READ:BURSt:MACCuracy:IQOFfset:MAXimum?		3.48
READ:BURSt:MACCuracy:OSUPpress:AVERage?		3.45
READ:BURSt:MACCuracy:OSUPpress:MAXimum?		3.45
READ:BURSt:MACCuracy:PEAK:AVERage?		3.44
READ:BURSt:MACCuracy:PEAK:MAXimum?		3.44
READ:BURSt:MACCuracy:PERCentile:AVERage?		3.46
READ:BURSt:MACCuracy:PERCentile:MAXimum?		3.46
READ:BURSt:MACCuracy:RMS:AVERage?		3.43
READ:BURSt:MACCuracy:RMS:MAXimum?		3.43
READ:BURSt:PERRor:PEAK:AVERage?		3.37
READ:BURSt:PERRor:PEAK:MAXimum?		3.37
READ:BURSt:PERRor:RMS:AVERage?		3.36
READ:BURSt:PERRor:RMS:MAXimum?		3.36
READ:BURSt:PTEMplate:REFerence[:IMMediate]?		3.41
READ:BURSt:PTEMplate:TRGS:AVERage?		3.41
READ:BURSt:PTEMplate:TRGS:MAXimum?		3.42

Command	Parameter	Page
READ:BURSt:REFerence[:IMMediate]?		3.42
READ:SPECtrum:MODulation:REFerence[:IMMediate]?		3.51
READ:SPECtrum:MODulation[:ALL]?		3.50
READ:SPECtrum:SWITching:REFerence[:IMMediate]?		3.52
READ:SPECtrum:SWITching[:ALL]?		3.52
STATus:QUEStionable:SYNC:CONDition?		3.56
STATus:QUEStionable:SYNC:ENABle	0 to 65535	3.56
STATus:QUEStionable:SYNC:NTRansition	0 to 65535	3.56
STATus:QUEStionable:SYNC:PTRansition	0 to 65535	3.56
STATus:QUEStionable:SYNC[:EVENt]?		3.56
TRACe<1|2>[:DATA]	TRACE1 | TRACE2 | TRACE3 , <block> | <numeric_value>	3.57
TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal	-460µs...8s	3.59
TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower	-460µs...8s	3.60
TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower	-460µs...8s	3.60

The following list contains all commands not available or available only with restrictions in GSM/EDGE mode.

Command	Parameter	Page
CALCulate<1|2>:DELTamarker<1...4>:FUNCtion:PNOise[:STATe]	not in GSM/EDGE mode	3.1
CALCulate<1|2>:DELTamarker<1...4>:FUNCtion:PNOise:RESult?	not in GSM/EDGE mode	3.1
CALCulate<1|2>:LIMit<1...8>:....	not for MAC /PFE measurements	3.2
CALCulate<1|2>:MARKer<1...4>:COUNt	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:COUNt:RESolution	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:COUNt:FREQuency?	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:STATe	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:RESult?	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:FREQuency?	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:NOISe[:STATe]	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:NOISe:RESult?	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:TOI[:STATe]	not for MAC /PFE /PVT measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:TOI:RESult?	not for MAC /PFE /CPW measurements	3.3
CALCulate<1|2>:MARKer<1...4>:FUNCtion:POWer...	not for GSM measurements	3.4
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MODE	not for MAC /PFE measurements	3.4
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:REFerence:AUTO	not for MAC /PFE measurements	3.4
CALCulate<1|2>:STATistics:..	not in GSM/EDGE mode	3.4
CALCulate<1|2>:UNIT:POWer	not in GSM/EDGE mode	3.4
DISPlay:FORmat	not for GSM/EDGE mode	3.14
DISPlay[WINDow<1|2>]:SELect	not for GSM/EDGE mode	3.14
DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing	not for GSM/EDGE mode	3.14
[SENSe:]BANDwidth|BWIDth[:RESolution]	not for MAC /PFE /PVT measurements	3.53
[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO	not for MAC /PFE /PVT measurements	3.53
[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution]:TYPE	not for MAC /PFE /PVT /CPW measurements	3.53
[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo	not for MAC /PFE /PVT measurements	3.53
[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:AUTO	not for MAC /PFE /PVT measurements	3.53
[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:RATio	not for MAC /PFE /PVT measurements	3.53
SENSe:CORRection:..	not in GSM/EDGE mode	3.53
[SENSe<1|2>:]DETector<1...3>[:FUNCtion]	not for MAC /PFE /PVT measurements	3.53
[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK	not for MAC /PFE /PVT measurements	3.54
[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK:FACTor	not for MAC /PFE /PVT measurements	3.54
[SENSe<1|2>:]FREQuency:SPAN	not for MAC /PFE /PVT /CPW measurements	3.54
[SENSe<1|2>:]FREQuency:SPAN:FULL	not for MAC /PFE /PVT /CPW measurements	3.54
[SENSe<1|2>:]FREQuency:STARt	not for MAC /PFE /PVT /CPW measurements	3.54
[SENSe<1|2>:]FREQuency:STOP	not for MAC /PFE /PVT /CPW measurements	3.54

Command	Parameter	Page
[SENSe<1|2>:]FREQuency:MODE	not for MAC /PFE /PVT /CPW /SPU measurements	3.54
[SENSe<1|2>:]LIST:...	not for MAC /PFE /PVT measurements	3.54
[SENSe<1|2>:]MPOWer:...	not for MAC /PFE /PVT measurements	3.55
SENSe<1|2>:POWer:...	not in GSM/EDGE mode	3.55
[SENSe<1|2>:]SWEep:TIME	not for MAC /PFE /PVT /CPW measurements	3.55
[SENSe<1|2>:]SWEep:TIME:AUTO	not for MAC /PFE /PVT /CPW measurements	3.55
[SENSe<1|2>:]SWEep:EGATe...	not for MAC /PFE /PVT /CPW /TRA /SPU measurements	3.55
TRACe<1|2>:IQ:...	not in GSM/EDGE mode	3.58
TRIGger<1|2>[:SEQuence]:SOURce	not in GSM/EDGE mode	3.59
UNIT<1|2>:POWer	not in GSM/EDGE mode	3.60

Table of Softkeys and Hotkeys with IEC/IEEE-Bus Command Assignment

Hotkey GSM/EDGE

GSM/EDGE	
REF LEVEL	DISPlay[:WINDow<1>]:TRACe<1 to 3>:Y[:SCALe]:RLEVel -130dBm to 30dBm
EXTERNAL ATTEN	DISPlay[:WINDow<1>]:TRACe<1 to 3>:Y[:SCALe]:RLEVel:OFFSet <num_value>
AUTO LEVEL&TIME	READ:AUTO:LEVTime?
TRIGGER OFFSET	-- (for remote control, the GSM trigger offset has to be set with commands TRIGger[:SEQuence]:SYNChronize:ADJust:...)
TRIGGER EXTERN	INSTrument[:SELect] MGSM TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal -460µs to 100s
TRIGGER IF POWER	INSTrument[:SELect] MGSM TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower -460µs to 100s
TRIGGER RF POWER	INSTrument[:SELect] MGSM TRIGger[:SEQuence]:SYNChronize:ADJust:RFPower -460µs to 100s (with option FSP-B6 only)
NO. OF BURSTS	[SENSe<1>:]SWEep:COUNt 0 to 32767
DEMOD SETTINGS	
SELECT MIDAMBLE	INSTrument[:SELect] MGSM CONFigure:CHANnel:TSC 0 to 7 | USER
SET USER MIDAMBLE	INSTrument[:SELect] MGSM CONFigure:CHANnel:TSC:USER <string>
BURST FIND	--
SYNC FIND	--
MULTISLOT	CONFigure:CHANnel:SLOT:MULTi ACT1SYNC1 | ACT2SYNC1 | ACT2SYNC2 | ACT3SYNC1 | ACT3SYNC2 | ACT3SYNC3 | ACT4SYNC1 | ACT4SYNC2 | ACT4SYNC3 | ACT4SYNC4 | ACT8SYNC1 | ACT8SYNC2 | ACT8SYNC3 | ACT8SYNC4 | ACT8SYNC5 | ACT8SYNC6 | ACT8SYNC7 | ACT8SYNC8
AUTO LEVEL&TIME	READ:AUTO:LEVTime?
POINT/SYMB 4 8	CONFigure:PRATe 4 | 8

MODULATION GMSK EDGE

```
CONFigure:MTYPe GMSK | EDGE
```

MODULATION ACCURACY

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe EDGE
CONFigure:BURSt:MACCuracy[:IMMediate]
SWEep:COUNt <num_value>
INITiate:IMMediate; *WAI
```

Query of result:

```
FETCh:BURSt:MACCuracy:RMS:AVERage?
FETCh:BURSt:MACCuracy:RMS:MAXimum?
FETCh:BURSt:MACCuracy:PEAK:AVERage?
FETCh:BURSt:MACCuracy:PEAK:MAXimum?
FETCh:BURSt:MACCuracy:OSUPress:AVERage?
FETCh:BURSt:MACCuracy:OSUPress:MAXimum?
FETCh:BURSt:MACCuracy:PERCentile:AVERage?
FETCh:BURSt:MACCuracy:PERCentile:MAXimum?
FETCh:BURSt:MACCuracy:FREQuency:AVERage?
FETCh:BURSt:MACCuracy:FREQuency:MAXimum?
FETCh:BURSt:MACCuracy:IQOFfset:AVERage?
FETCh:BURSt:MACCuracy:IQOFfset:MAXimum?
FETCh:BURSt:MACCuracy:IQIMbalance:AVERage?
FETCh:BURSt:MACCuracy:IQIMbalance:MAXimum?
```

PHASE/FREQ ERROR

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK
CONFigure:BURSt:PFERror[:IMMediate]
SWEep:COUNt <num_value>
INITiate:IMMediate; *WAI
```

Query of result:

```
FETCh:BURSt:PERRor:RMS:AVERage?
FETCh:BURSt:PERRor:RMS:MAXimum?
FETCh:BURSt:PERRor:PEAK:AVERage?
FETCh:BURSt:PERRor:PEAK:MAXimum?
FETCh:BURSt:FERRor:AVERage?
FETCh:BURSt:FERRor:MAXimum?
FETCh:BURSt:IQOFfset:AVERage?
FETCh:BURSt:IQOFfset:MAXimum?
FETCh:BURSt:IQIMbalance:AVERage?
FETCh:BURSt:IQIMbalance:MAXimum?
```

CARRIER POWER

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:BURSt:POWer[:IMMediate]
SWEep:COUNt <num_value>
INITiate:IMMediate; *WAI
```

Query of result:

```
CALCulate:MARKer:FUNCtion:SUMMary:MEAN:RESult?
CALCulate1:LIMit1:NAME 'CPWU_G' | 'CPWU_E'
CALCulate1:LIMit2:NAME 'CPWL_G' | 'CPWU_E'
CALCulate1:LIMit1:FAIL?
CALCulate1:LIMit2:FAIL?
```

POWER VS TIME

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect FULL
SWEep:COUNt  <num_value>
READ:BURSt:PTEMplate:REFerence[:IMMediate]? (premeasurement)
INITiate:IMMediate; *WAI
```

Query of result:

```
FETCh:BURSt:PTEMplate:TRGS:AVERage?
FETCh:BURSt:PTEMplate:TRGS:MAXimum?
CALCulate1:LIMit1:NAME 'PVTU_G' | 'PVTU_E'
CALCulate1:LIMit2:NAME 'PVTL_G' | 'PVTL_E'
CALCulate1:LIMit1:FAIL?
CALCulate1:LIMit2:FAIL?
```

Notes:
- *For setting* `CONFigure:BURSt:PTEMplate:SELect FULL` *and* `TOP`, *the carrier power (CPW) can be queried via command*
  `CALCulate:MARKer:FUNCtion:SUMMary:MEAN:RESult?`
- *In the case of multislot measurements, a digit is appended to the name of the limit line to indicate the number of active slots., e.g.. PVT_E4.*

FULL BURST

```
INSTrument[:SELect] MGSM
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect FULL
```

RISING EDGE

```
INSTrument[:SELect] MGSM
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect RISing
```

FALLING EDGE

```
INSTrument[:SELect] MGSM
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect FALLing
```

TOP HIGH RESOL

```
INSTrument[:SELect] MGSM
CONFigure:BURSt:PTEMplate[:IMMediate]
CONFigure:BURSt:PTEMplate:SELect TOP
```

START REF MEAS

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:BURSt:PTEMplate[:IMMediate]
READ:BURSt:PTEMplate:REFerence[:IMMediate]?
```

Query of result is included in READ command

MODULATION SPECTRUM

FREQUENCY SWEEP

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt <num_value>
READ:SPECtrum:MODulation:REFerence[:IMMediate]? (premeasurement)
INITiate:IMMediate; *WAI
```

Query of result:

```
CALCulate1:LIMit1:NAME 'MODU_G' | 'MODU_E'
CALCulate1:LIMit1:FAIL?
```

START LIST

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt <num_value>
READ:SPECtrum:MODulation:REFerence[:IMMediate]? (premeasurement)
READ:SPECtrum:MODulation[:ALL]?
```

Query of result is included in READ commands

LIST RESULTS

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
FETCh:SPECtrum:MODulation:REFerence?
FETCh:SPECtrum:MODulation[:ALL]? ARFCn
```

START REF MEAS

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
READ:SPECtrum:MODulation:REFerence[:IMMediate]?
```

Query of result is included in READ command.

TRANSIENT SPECTRUM

FREQUENCY SWEEP

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:BURSt:SWITching[:IMMediate]
SWEep:COUNt <num_value>
INITiate:IMMediate; *WAI
```

Query of result:

```
CALCulate1:LIMit1:NAME 'TRAU_G' | 'TRAU_E'
CALCulate1:LIMit1:FAIL?
```

START LIST

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
SWEep:COUNt <num_value>
READ:SPECtrum:SWITching[:ALL]?
```

Query of result is included in READ command

LIST RESULTS

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:BURSt:SWITching[:IMMediate]
FETCh:SPECtrum:SWITching[:ALL]?
```

LIMIT ABS REL

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
CONFigure:SPECtrum:SWITching:LIMit ABSolute | RELative
SWEep:COUNt <num_value>
READ:SPECtrum:SWITching:REFerence[:IMMediate]? (premeas., only LIM REL)
INITiate:IMMediate; *WAI
FETCh:SPECtrum:SWITching[:ALL]?
```

START REF MEAS

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
CONFigure:SPECtrum:SWITching:LIMit RELative | ABSolute
READ:SPECtrum:SWITching:REference[:IMMeadiate]?
```

SPURIOUS

```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPURious[:IMMediate]
SWEep:COUNt <num_value>
INITiate:IMMediate; *WAI
```

Query of result:

```
CALCulate:MARKer ON
CALCulate:MARKer:MAXimum
CALCulate:MARKer:MAXimum:NEXT
```
(the marker marks the peak spurious))
```
CALCulate:MARKer:X?;Y?
```

LINES Key

RESTORE GSM LINES

```
INSTrument[:SELect] MGSM
CONFigure:RESTore
```

Status Reporting Registers for GSM/EDGE Measurements

Overview of Status Registers

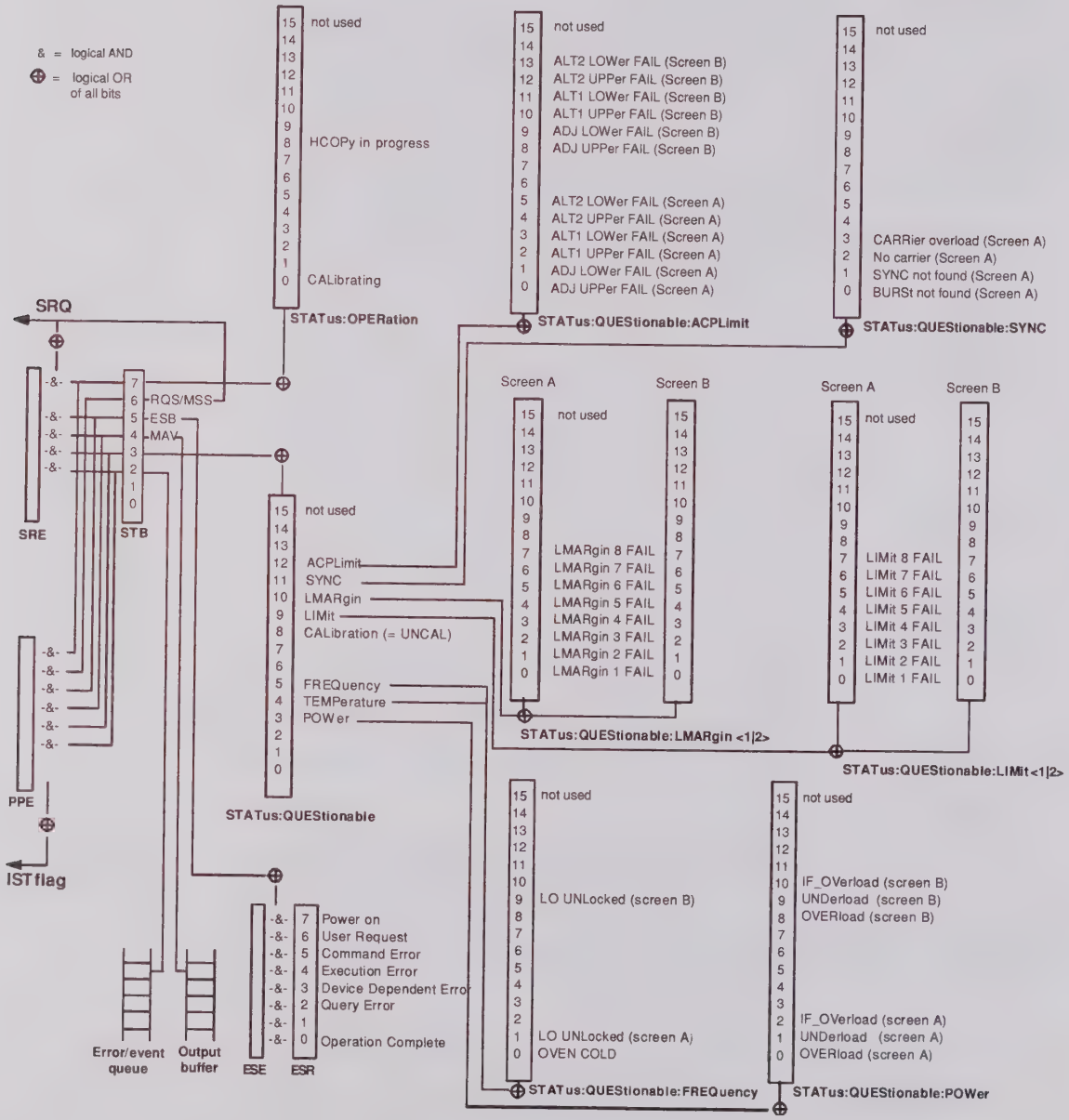


Fig 3-1 Overview of Status Registers

STATus:QUEStionable Register

This register comprises information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be queried by commands `STATus:QUEStionable:CONDition?` and `STATus:QUEStionable[:EVENt]?`.
For GSM/EDGE mode (FS-K5), the sum bit number 11 is defined.

Table 3-1 Meaning of bits in STATus:QUEStionable register

Bit No.	Meaning
0 to 2	These bits are not used.
3	**POWer** This bit is set if a questionable power occurs (see also section "STATus:QUEStionable:POWer Register").
4	**TEMPerature** This bit is set if a questionable temperature occurs.
5	**FREQuency** The bit is set if a frequency is questionable (see also section "STATus:QUEStionable:FREQuency Register").
6 to 7	These bits are not used.
8	**CALibration** The bit is set if a measurement is performed uncalibrated (=;^ label "UNCAL").
9	**LIMit** (device-dependent) This bit is set if a limit value is violated (see also section STATus:QUEStionable:LIMit Register).
10	**LMARgin** (device-dependent) This bit is set if a margin is violated (see also section STATus:QUEStionable:LMARgin Register).
11	**SYNC** (device-dependent) This bit is set if, in measurements or premeasurements in GSM/EDGE mode, synchronization to midamble fails or no burst is found. This bit is also set if, in premeasurements in GSM/EDGE mode, the result differs too strongly from the expected value (see also "STATus:QUEStionable:SYNC Register").
12	**ACPLimit** (device-dependent) This bit is set if a limit for the adjacent channel power measurement is violated (see also section "STATus:QUEStionable:ACPLimit Register").
13 to 14	These bits are not used.
15	This bit is always 0.

STATus-QUEStionable:SYNC Register

This register is used only with GSM/EDGE mode. It contains information about sync and bursts not found, and about premeasurement results exceeding or falling short of expected values.
The bits can be queried with commands "`STATus:QUEStionable:SYNC:CONDition?`" and "`STATus:QUEStionable:SYNC[:EVENt]?`".

Table 3-2 Meaning of bits in STATus:QUEstionable:SYNC register

Bit No.	Meaning
0	**BURSt not found (screen A)** This bit is set if no burst is found in the measurements/premeasurements for phase/frequency error (PFE) or carrier power versus time (PVT) in GSM/EDGE mode. If a burst is found in these measurements/premeasurements, the bit is reset.
1	**SYNC not found (screen A)** This bit is set if the synchronization sequence (training sequence) of the midamble is not found in the measurements/premeasurements for phase/frequency error (PFE) or carrier power versus time (PVT) in GSM/EDGE mode. If the synchronization sequence (training sequence) of the midamble is found in these measurements/premeasurements, the bit is reset.
2	**No carrier (screen A)** This bit is set if, in GSM/EDGE mode, the level value determined in the premeasurements for carrier power versus time (PVT) and spectrum due to modulation is too low. The bit is reset at the beginning of the premeasurement (see also Chapter 2, description of the named premeasurements).
3	**Carrier overload (screen A)** This bit is set if, in GSM/EDGE mode, the level value determined in the premeasurements for carrier versus time (PVT) and spectrum due to modulation is too high. The bit is reset at the beginning of the premeasurement (see also Chapter 2, description of the named premeasurements).
4-14	Not used.
15	This bit is always 0.

Index

Note: *The softkeys are listed alphebetically under the keyword "Softkey".*

8

8PSK *1.1*
Midamble *2.9, 3.7*
selection *3.8*

A

Aborting a measurement *1.8*
ARFCN *1.1*

B

BURST FIND always ON in this version *1.15*
Burst not found *1.13*
Burst timing *2.35*

C

Carrier Overload Bit *2.42, 2.57, 2.71*
Carrier power *2.28*
Carrier power vs. time *2.35*
Carrier signal, not detected *1.13*
Command
Description *3.1*

E

EDGE *1.1, 1.4*
Midamble *2.9, 3.7*
selection *3.8*
Edge of a burst *2.39, 2.40*
Errors and difficulties during measurement *1.13*
Ext Trig/Gate In input *2.6*

F

FAILED *1.8*
FDMA *1.1*
FREQ AVG *2.17, 2.23*
FREQ HLD *2.17*

G

GMSK *1.1*
Midamble *2.9, 3.7*
selection *3.8*
GPRS *1.4*
GSM AUTO LEVEL & TIME in progress *1.15*
GSM AUTO LEVEL TIME ok *1.15*
GSM AUTO LEVEL/TIME MEAS *1.15*
GSM LIST MEAS in progress *1.14*
GSM MOD LIST MEAS Aborted *1.14*
GSM PVT REF MEAS Aborted *1.14*
GSM REF MEAS in progress *1.14*
GSM TRA LIST MEASAborted *1.14*
GSM/EDGE *2.1*

H

Hotkey
GSM/EDGE *1.6, 2.1*
HSCSD *1.4*

I

IF Power Trigger active *1.14*
Input
Ext Trig/Gate In *2.6*

K

Key
FREQ *2.14*

L

LIMIT LINE ERROR! No or wrong limit line or limit checks disabled on TRACE1' *1.15*

M

MARGIN *1.8*
Measurement
aborting *1.8*
Measurements
results *1.8*
Messages from the GSM/EDGE software *1.14*

N

No Carrier Bit *2.43, 2.57, 2.71*
NOTE! BURST FIND always ON in this version *1.15*
NOTE! SYNC FIND always ON in this version *1.15*

P

PASSED *1.8*
PEAK AVG *2.17*
PEAK HLD *2.17*
Phase/frequency error *2.22*
Power vs. time *2.35*

R

REF LEVEL too high DECREASE REF LEVEL *1.14*
REF LEVEL too low INCREASE REF LEVEL *1.14*
Results of measurements *1.8*
RMS AVG *2.17*
RMS HLD *2.17*

S

Signal power = ***.* dBm 2.43
Signal power = ppp.p dBm. REFERENCE LEVEL too high! DECREASE REFERENCE LEVEL! 2.43, 2.57, 2.71
Signal power = ppp.p dBm. REFERENCE LEVEL too low! INCREASE REFERENCE LEVEL! 2.42, 2.57, 2.70
Slow frequency hopping 2.19, 2.25
Softkey
- AUTO LEVEL & TIME 2.5, 2.12
- BURS HIGH RESOLUTION 2.41
- BURST FIND 2.10
- CARRIER POWER 2.29
- DEMOD SETTINGS 2.8
- EXTERNAL ATTEN 2.4
- FALLING EDGE 2.40
- FULL BURST 2.37
- GENERAL SETTINGS 2.3
- LIST RESULTS 2.56, 2.69
- MODULATION GMSK / 8PSK 2.12
- MODULATION SPECTRUM 2.52
- NO. OF BURSTS 2.7
- PHASE/FREQ ERROR 2.17, 2.23
- POINT/SYMB 2.12
- POWER VS TIME 2.36
- REF LEVEL 2.4
- REFERENCE INT/EXT 2.3
- RESTORE GSM LINES 2.13
- RISING EDGE 2.39
- SELECT MIDAMBLE 2.8, 2.10
- SINGLE FREQ SWEEP 2.52, 2.53, 2.66, 2.67
- START LIST 2.54, 2.68
- START REF MEAS 2.42
- SYNC FIND 2.10
- TRANSIENT SPECTRUM 2.66
- TRIGGER EXTERN 2.6
- TRIGGER IF POWER 2.6
- TRIGGER OFFSET 2.5
- TRIGGER RF POWER 2.7

Softkey SET USER MIDAMBLE 2.9
Spectrum due to modulation 2.50
Spurious 2.77
Spurious, measuring 2.77
STATus
- QUEStionable-Register 3.71

Status register
- STATus QUEStionable
  - SYNC 3.56
- STATus-QUEStionable
  - SYNC 3.72

STATus\:QUEStionable register 3.71
- SYNC 3.72

SYNC FIND always ON in this version 1.15
Sync not found 1.13
SYNC NOT FOUND 2.45

T

TDMA 1.1
Trigger
- not detected 1.13

Trigger and time references 1.11
Trigger Offset between external Trigger and 'begin of slot' 1.15
Trigger Offset between IF Power Trigger and 'begin of slot' 1.15

W

WARNING! Carrier Overload! 1.15
WARNING! No Carrier! 1.15
WARNING! REF LEVEL too high DECREASE REF LEVEL 1.14
WARNING! REF LEVEL too low INCREASE REF LEVEL 1.14
WARNING! Signal power = ppp.p dBm. REFERENCE LEVEL too high! DECREASE REFERENCE LEVEL! ..2.43, 2.57, 2.71
WARNING! Signal power = ppp.p dBm. REFERENCE LEVEL too low! INCREASE REFERENCE LEVEL! 2.42, 2.57, 2.70